WESTERN BIRDS

Vol. 33, No. 1, 2002

Volume 33, Number 1, 2002

Report of the California Bird Records Committee: 1999 Records *Michael M. Rogers and Alvaro Jaramillo* 1

Autumn Populations of Birds in Riparian Habitat of California's Central Valley *Diana L. Humple and Geoffrey R. Geupel* 34

Winter Foraging Habitat of Greater Sandhill Cranes in Northern California *Carroll D. Littlefield* 51

Book Reviews *Martin Meyers, Dennis R. Paulson* 61

Featured Photo *Kimball L. Garrett* 65

Cover photo by © Larry Sansone of Los Angeles, California: Common Greenshank (*Tringa nebularia*), McKinleyville, Humboldt County, California, August, 2001. This is the first record of Common Greenshank for the state of California.

Western Birds solicits papers that are both useful to and understandable by amateur field ornithologists and also contribute significantly to scientific literature. The journal welcomes contributions from both professionals and amateurs. Appropriate topics include distribution, migration, status, identification, geographic variation, conservation, behavior, ecology, population dynamics, habitat requirements, the effects of pollution, and techniques for censusing, sound recording, and photographing birds in the field. Papers of general interest will be considered regardless of their geographic origin, but particularly desired are reports of studies done in or bearing on the Rocky Mountain and Pacific states and provinces, including Alaska and Hawaii, western Texas, northwestern Mexico, and the northeastern Pacific Ocean.

Send manuscripts to Kathy Molina, Section of Ornithology, Natural History Museum of Los Angeles County, 900 Exposition Blvd., Los Angeles, CA 90007. For matter of style consult the Suggestions to *Contributors to Western Birds* (8 pages available at no cost from the editor) and the *Council of Biology Editors Style Manual* (available for $24 from the Council of Biology Editors, Inc., 9650 Rockville Pike, Bethesda, MD 20814).

Reprints can be ordered at author's expense from the Editor when proof is returned or earlier.

Good photographs of rare and unusual birds, unaccompanied by an article but with caption including species, date, locality and other pertinent information, are wanted for publication in Western Birds. Submit photos and captions to Photo Editor. Also needed are black and white pen and ink drawings of western birds. Please send these, with captions, to Graphics Manager.

WESTERN BIRDS

Volume 33, Number 1, 2002

REPORT OF THE CALIFORNIA BIRD RECORDS COMMITTEE: 1999 RECORDS

MICHAEL M. ROGERS, 499 Novato Ave., Sunnyvale, California 94086

ALVARO JARAMILLO, San Francisco Bay Bird Observatory, P. O. Box 247, Alviso, California 95002

ABSTRACT: The California Bird Records Committee reached decisions on 204 records involving 88 species in 1999, endorsing 150 of them. New to California was the Shy Albatross (*Thalassarche cauta*), extensively photographed 9 nautical miles W of Point Arena, Mendocino County. Also added to the state list was the Red-crowned Parrot (*Amazona viridigenalis*), now established in southern California cities and constituting the ninth nonnative species on the state list. The Three-toed Woodpecker (*Picoides tridactylus*) was removed from the state list following a reassessment of the lone single-observer sight record of this species, from Modoc County in 1985. Adjusted for these changes, California's bird list stands at 614 species.

This 25th report of the California Bird Records Committee (hereafter the CBRC or the Committee) details the evaluation of 204 records involving 88 species. Although most records pertain to birds found in 1999, the period covered by this report spans the 102 years from 1899 to 2000. Seven of these records were not new but rather were reassessments of earlier decisions reached by the Committee. Accepted were 150 records involving 69 species. The acceptance rate of 73.5% was typical for the last decade but below the overall Committee average (Rottenborn and Morlan 2000). Forty-nine records were not accepted because of insufficient documentation or because descriptions were inconsistent with known identification criteria. Five additional records were not accepted because of questions concerning the bird's natural occurrence. Counties best represented by accepted records were Monterey (20 records, 6 of them Manx Shearwaters), San Francisco (14, all from Southeast Farallon I. except two pelagic Parakeet Auklets), San Diego (14), Inyo (12), Santa Barbara (10), and Kern (9). Records were accepted from 20 other counties.

Highlights of this report include the addition of two species to the California list, the Shy Albatross (*Thalassarche cauta*) and Red-crowned Parrot (*Amazona viridigenalis*). Additionally, this report includes the re-

moval of the Three-toed Woodpecker (*Picoides tridactylus)* from the list. The Northern Bobwhite (*Colinus virginianus*) and Eastern Bluebird (*Sialia sialis*), potential first state records, were not accepted because the documentation for these reports was insufficient to establish the identification. The Gray Silky-flycatcher (*Ptilogonys cinereus*) failed to gain acceptance because of concerns over questionable natural occurrence; this species remains on the Supplemental List. With these changes, California's list stands at 614 species, nine of which are nonnative and two of which have been extirpated within historical times. The acceptance of the Glossy Ibis (*Plegadis falcinellus*), Nutting's Flycatcher (*Myiarchus nuttingi*), Greater Sandplover (*Charadrius leschenaultii*), Eyebrowed Thrush (*Turdus obscurus*), and Common Greenshank (*Tringa nebularia*) to the state list will be addressed in future reports, along with the reasoning for not endorsing records of a Markham's Storm-Petrel (*Oceanodroma markhami*), a Pink-backed Pelican (*Pelecanus rufescens*), a Darter (*Anhinga melanogaster*), a Masked Duck (*Nomonyx dominicus*), a Wood Sandpiper (*Tringa glareola*), another Slaty-backed Gull (*Larus schistisagus*), and a Blue Mockingbird (*Melanotis caerulescens*). No conclusion has yet been reached on records of the Nazca Booby (*Sula granti*), Falcated Duck (*Anas falcata*), Demoiselle Crane (*Anthropoides virgo*), Eurasian Collared-Dove (*Streptopelia decaocto*), Yellow-breasted Bunting (*Emberiza aureola*), and Black-backed Oriole (*Icterus abeillei*).

Other highlights include the return of California's first Bridled Tern (*Sterna anaethetus*), the second accepted records of the Great-winged Petrel (*Pterodroma macroptera*) and White-winged Tern (*Chlidonias leucopterus*), the fourth accepted records of the Arctic Loon (*Gavia arctica*) and Wedge-tailed Shearwater (*Puffinus pacificus*), and the fifth accepted records of the Violet-crowned Hummingbird (*Amazilia violiceps*) and Red-headed Woodpecker (*Melanerpes erythrocephalus*). Species recorded in especially high numbers in 1999 included the Manx Shearwater (*Puffinus puffinus*; 7 accepted records with three more in circulation), Brown Booby (*Sula leucogaster;* 9 accepted records), Yellow-throated Vireo (*Vireo flavifron;* 5 accepted records), and Painted Bunting (*Passerina ciris*; 6 accepted records).

The list of species reviewed by the CBRC is posted at the Western Field Ornithologists' web site (http://www.wfo-cbrc.org). This site also includes the entire California state list, the Committee's bylaws, a reporting form for the direct e-mail submission of records to the CBRC, the addresses of current Committee members, a photo gallery of recent submissions, including several birds published in this report, a list of relevant publications by CBRC members, and other information about the CBRC, WFO, and its journal, *Western Birds*.

All documentation reviewed by the CBRC, including copies of descriptions, photographs, videotapes, audio recordings and Committee comments, is archived at the Western Foundation of Vertebrate Zoology, 439 Calle San Pablo, Camarillo, California 93012, and is available for public review. The CBRC solicits and encourages observers to submit documentation for all species on the review list, as well as species unrecorded in

California. Documentation should be sent to Guy McCaskie, CBRC secretary, P. O. Box 275, Imperial Beach, CA 91933-0275 (e-mail: guymcc@pacbell.net).

Committee News. The Committee's voting membership after the 6 January 2001 annual meeting consisted of Jon L. Dunn, Richard A. Erickson (chairman), Kimball L. Garrett (vice chairman), Robert A. Hamilton, Tristan McKee, Joseph Morlan, Michael A. Patten, Peter Pyle, Scott B. Terrill, and John C. Wilson. After serving as a regular member for 30 years, Guy McCaskie has assumed the duties of a nonvoting secretary. Recent Committee members who also voted on many of the records in this report include Matthew T. Heindel, Alvaro Jaramillo, Guy McCaskie, Michael M. Rogers, Stephen C. Rottenborn, Mike San Miguel, and Daniel S. Singer.

No changes were made to the review list at the Committee's January 2001 meeting. The Cape May Warbler (*Dendroica tigrina*) and the Bay-breasted Warbler (*Dendroica castanea*) may be considered for possible addition to the review list, pending demonstration of their declines in recent years. The Mourning Warbler (*Oporornis philadelphia*) and the Scarlet Tanager (*Piranga olivacea*) each now have over 100 accepted records and could be candidates for removal from the review list. In light of the recent split of the Masked (*Sula dactylatra*) and Nazca (*S. granti*) Boobies, the Committee is reconsidering all records of juvenile "Masked" Boobies. All records of adults and sub-adults are of *dactylatra*.

Format and Abbreviations. As in other recent CBRC reports, records are generally listed geographically, from north to south, and/or chronologically by first date of occurrence. Included with each record is the location, county abbreviation (see below), and date span. The date span usually follows that published in *North American Birds* (formerly *American Birds* or *Field Notes*) but, if the CBRC accepts a date span that differs from a published source, the differing dates are italicized. Initials of the observer(s) responsible for finding and/or identifying the bird(s)—if known and if they have supplied supportive documentation—are followed by a semicolon, then the initials, in alphabetized order by surname, of additional observers submitting supportive documentation, then the CBRC record number consisting of the year of observation and chronological number assigned by the secretary. All records are sight records unless otherwise indicated: initials followed by a dagger (†) mean the observer supplied a supportive photograph, (‡) videotape, (§) a voice recording, and (#) a specimen, followed by the acronym (see below) of the institution housing the specimen and that institution's specimen catalog number.

An asterisk (*) prior to a species' name indicates that the species is no longer on the CBRC's review list. The first number in parentheses after the species' name is the number of records accepted by the CBRC through this report; the second is the number of new records accepted in this report (because this number excludes records thought to pertain to returning individuals, it may be zero). Two asterisks (**) after the species' total indicate that the number of accepted records refers only to a restricted review period or includes records accepted for statistical purposes only; see Roberson (1986) for more information.

When individual birds return to a location after a lengthy or seasonal absence, each occurrence is reviewed under a separate record number and Committee members indicate whether or not they believe the bird is the same as one accepted previously. Such decisions follow the opinion of the majority of members, and, if a bird is considered a returning individual, the total number of records remains unchanged.

Although the CBRC does not formally review the age, sex, or subspecies of each bird, information on these subjects is often provided during the review process (and in some cases a strong or unanimous consensus is achieved). We report much of this information.

The CBRC uses standard abbreviations for California counties; those used in this report are DN, Del Norte; FRE, Fresno; GLE, Glenn; HUM, Humboldt; IMP, Imperial; INY, Inyo; KER, Kern; KIN, Kings; LAK, Lake; LA, Los Angeles; MRN, Marin; MEN, Mendocino; MOD, Modoc; MNO, Mono; MTY, Monterey; ORA, Orange; RIV, Riverside; SBE, San Bernardino; SD, San Diego; SF, San Francisco; SJ, San Joaquin; SM, San Mateo; SLO, San Luis Obispo; SBA, Santa Barbara; SCL, Santa Clara; SCZ, Santa Cruz; SIS, Siskiyou; SON, Sonoma; TUO, Tuolumne; VEN, Ventura; YOL, Yolo. A full list of county abbreviations is available on the WFO–CBRC website. Other abbreviations used: I., island; L., lake; Mt., mountain; n. miles, nautical miles; N. W. R., national wildlife refuge; Pt., point; R., river.

Museum collections housing specimens cited in this report, allowing access to Committee members for research, or otherwise cited, are the California Academy of Sciences, San Francisco (CAS), Humboldt State University Wildlife Museum (HSUWM), Natural History Museum of Los Angeles County, Los Angeles (LACM), Museum of Vertebrate Zoology, University of California, Berkeley (MVZ), San Bernardino County Museum, Redlands (SBCM), Santa Barbara Museum of Natural History (SBMNH), and the San Diego Natural History Museum (SDNHM).

RECORDS ACCEPTED

ARCTIC LOON *Gavia arctica* (4, 1). One in first basic plumage off Bodega Head, SON, 10 May 1999 (SNGH, CC; 1999-104) was the fourth of this species recorded in California. All have been along the central coast. The two observers detailed their observations well, and cautiously. The identification was based almost exclusively on the large white patch evident on the bird's posterior flanks. This feature is considered diagnostic in the separation of these two very similar species (Birch and Lee 1997), and only one member felt the identification had not been established.

SHY ALBATROSS *Thalassarche cauta* (1, 1). An adult, or near adult, was 9 n. miles W of Pt. Arena (38° 57′ 08″ N, 123° 55′ 40″ W), MEN, 24 Aug 1999 (JDa, TMcK; LCo, RJK†, PP, DLSh†, AW†, SW; 1999-139; Figure 1). Another observation of what may have been the same individual at "the Football," 14 n. miles SW of Horsehoe Pt., SON, 25 Sep 1999 is under review. Albatross taxonomy is currently in flux, with Robertson and Nunn (1998) proposing splitting the Shy Albatross complex into as many as four species. Currently the AOU (1998) considers the Shy Albatross to be one variable species. The largely white head, extensive white on the underside of the primaries, and pale bill with yellowish tip allow this individual to be identified as either nominate *cauta* or *steadi* rather than the dark-headed *salvini* or *eremita*. A well-researched argument was made that this individual was best identified as *cauta* in

the strict sense, also known as the "Tasmanian Albatross." This identification was based largely on aspects of the bill color, particularly the presence of yellow at the base of the culminicorn, as well as the coloring of the face (Cole 2000). Because of the recent proposal of these field marks, and uncertainty regarding their variability, the Committee felt that identification of this bird only as *cauta/steadi* was best at this time. Color photographs of this bird were published by Cole (2000) and in *N. Am. Birds* 54:116. Remarkably, following this first state record, four additional Shy Albatrosses have been reported off central California between 27 July and 17 September, apparently most of the subspecies *salvini* [*N. Am. Birds* 55 (4)].

SHORT-TAILED ALBATROSS *Phoebastria albatrus* (8**, 1). One was 15 n. miles W of Cypress Pt., in Monterey Bay (36° 34.38′N, 122° 18.56′W), MTY, 7 Aug 1999 (TMcK; DLSh, JSo†, LT‡, SBT†; 1999-151). This bird had the entirely brown plumage typical of younger immatures but was quite worn and had pale eye crescents and the possible beginnings of a pale wing patch. Eye crescents develop through a protracted second prebasic molt during a Short-tailed Albatross' first spring/summer, while a patch of white at the base of the bill develops during the molt in its second spring/summer. This bird was entirely dark area around the bill but did have eye crescents, suggesting that it was a year old when observed. If the pale wing patches were the beginnings of the white upperwings of adults, rather than an effect of wear, the bird may have been two years old (H. Hasagawa pers. comm. to P. Pyle). Another Short-tailed Albatross observed off Pebble Beach, MTY, in early May 1999, thought to be a different bird, is still under review.

GREAT-WINGED PETREL *Pterodroma macroptera* (2, 1). One individual was copiously photographed 9.6 n. miles WNW of Pt. Pinos (36° 42.06′ N, 122° 7.27′ W), MTY, 18 Oct 1998 (SNGH; RLB†, SJD†, ADeM, AME, GE†, SG, EG†, TMcG, JPn†, DGS, DLSh, JSo†, SW; 1998-163; Figure 2). The only other one recorded off California, also the first for the northern hemisphere, was at Cordell Bank, MRN, 21 Jul–24 Aug 1996 (Rotternborn and Morlan 2000). Identification of dark *Pterodroma* petrels is complex. Most similar to the Great-winged are the Solander's (Providence) Petrel (*P. solandri*), which has not been recorded in North America, and the regularly occurring Murphy's Petrel (*P. ultima*). A thorough review of these identification contenders by the reporting observers, as well as an expert opinion from Tony Palliser of Australia, indicated that this bird was a Great-winged Petrel. The large size, uniform coloration, and large thick-set bill are characteristics of the Great-winged and not Murphy's. Despite this, the apparent hooded appearance in some photographs, a slightly paler patch at the base of the primaries, and an uncertainty over how large the bill of a Murphy's Petrel can be left one member unconvinced that Murphy's could be eliminated definitively. Solander's Petrel shows a bold white patch at the base of the underside of the primaries, and it shows an indistinct darker "M" pattern on the upperwing, both of which the Pt. Pinos bird lacked. According to Palliser, another potentially useful characteristic is that Solander's has an entirely black bill, while the Great-winged shows a pale patch at the base of the maxillary unguis (the terminal expansion of the maxilla). This new field mark is still being evaluated in Australia but may be diagnostic. Photographs of the Monterey Bay bird show this pale patch well. As with the previous California record, extensive white on the face of this bird suggested it was of the race *gouldi*. A color photograph appeared on the cover of *N. Am. Birds* 53 (1).

WEDGE-TAILED SHEARWATER *Puffinus pacificus* (4, 1). One pale-morph individual was photographed in Monterey Bay (36° 36.90′N, 121° 53.44′W), 0.4 n. miles from the Coast Guard breakwater at the entrance to the harbor, MTY, 26 Sep 1999 (DLSh†; CK, TMcK, JSo†; 1999-189). The four U.S. records to date are now evenly split between the pale and dark morphs. These records' dates (31 July to 10–21 October) suggest a late summer/fall pattern of occurrence, although this is also the

period of greatest coverage by pelagic boat trips. This warm-water species, regularly found off Baja California Sur, Mexico (Howell and Webb 1995, Stallcup 1990), should be looked for particularly in years of warm water. Howell and Webb (1995) noted that 70–90% of the 1000 pairs breeding on San Benedicto I., Mexico, are of the dark morph, suggesting that at least some of the California birds came from Hawaiian populations, which are 90–95% of the pale morph. Of course, a dark-morph bird at the Salton Sea in 1988 (1988-150, Pyle and McCaskie 1992) almost certainly originated from Mexico, and a larger sample size is needed for more meaningful inferences. A black-and-white photograph of the 1999 bird appeared in *N. Am. Birds* 54:100.

MANX SHEARWATER *Puffinus puffinus* (52, 9). A total of seven during 1999 is an increase from 1998, when only five were accepted (Erickson and Hamilton 2001). Furthermore, several reports in 1999 were not submitted to the Committee. On the other hand, some of these records may pertain to the same bird(s) being observed repeatedly. Cold sea-surface temperatures due to the La Niña phenomenon dominated all of 1999. Almost certainly because of this, Black-vented Shearwaters (*P. opisthomelas*), which are associated with warmer waters, were nearly absent from northern California then, with only two reports between Apr 1999 and Feb 2000 (*N. Am. Birds* 53:325, 54:100, 217). The result was a rare inequality in which the Manx became the more commonly observed small shearwater off northern California. It may be that the absence of Black-vented Shearwaters made Manx shearwaters more detectable. The seven 1999 records are as follows: One was 0.8 n. miles N of Pt. Pinos on Monterey Bay (36° 39.09′ N, 121° 55.56′ W), MTY, 18 Jan 1999 (TMcK; ADeM, DLSh; 1999-068), and one was in Monterey Bay (36° 49.98′ N, 122° 07.37′ W), SCZ, 13 Feb 1999 (DLSh; RC; 1999-069). These are the fifth and sixth accepted winter records (December–February). One approximately 5 n. miles NW of Pt. Pinos (36° 42′ N; 122° 00′ W), MTY, 15 May 1999 (SNGH; 1999-105) made only the sixth spring record from the state. The window of spring occurrence now spans 22 March–15 May. One was observed 9 n. miles WNW of Pt. Pinos on Monterey Bay, MTY, 31 Jul 1999 (DR; SFB; 1999-146). This is the second accepted summer record (June–July). The rest were all in fall, when most Manx Shearwaters are observed in the state. One was in Monterey Bay (36° 35.69′ N, 122° 8.56′ W), MTY, 11 Aug 1999 (TMcK; SSo; 1999-132). Another 5 miles off Emma Wood State Beach, VEN, *19* Sep 1999 (STu; DD; 1999-152) constituted the first state record south of Morro Bay. Finally, one was in Monterey Bay (36° 35′ 08″ N, 122° 01′ 07″ W), MTY, 9 Oct 1999 (MAP, MMR; 1999-166). Three additional 1999 reports are currently in circulation. An older report of a bird 6 miles NW of Moss Landing in Monterey Bay, SCZ, 20 Oct 1996 (JDs; 1999-028) went three rounds before being accepted unanimously. The concern was that the description did not adequately eliminate Newell's Shearwater [*P.* (*auricularis*?) *newelli*] from Hawaii, a species yet to be reported from our coast. Another pre-1999 record not previously published was of a bird 1 n. mile north of Otter Pt. in Monterey Bay (36° 38.12′ N, 121° 54.21′ W), MTY, 25 Oct 1998 (ADeM; DGS; 1998-186).

RED-TAILED TROPICBIRD *Phaethon rubricauda* (19, 1). An adult was observed at Bolsa Chica, ORA, 10 Jul 1999 (JEP, DRW; 2000-062). Given that most records of this species come from fall or winter and at substantial distances from land, this is a remarkable record indeed. The bird was seen well, and the white wings and red tail were well described.

MASKED BOOBY *Sula dactylatra* (14, 3). A subadult seen from Cardwell Pt., San Miguel I. (33° 59.6′ N, 120° 21.7′ W), SBA, 16 Feb 1998 (SB†, PMcN; 1998-063) and another off the San Pedro Breakwater, Los Angeles, LA, 13 Nov 1999 (HC†, MJSM; 1999-193) were old enough to have acquired adult bill coloration, identifying

them as Masked Boobies, rather than the recently split Nazca Booby (*S. granti*; Pitman and Jehl 1998, Roberson 1998). A juvenile 7.9 n. miles SW of Wilder Ranch on Monterey Bay (36° 49′ 44″ N, 122° 08′ 67″ W), SCZ, 13 Feb 1999 (JSo†; RC, ADeM, AME, DHR, PR†, RTe†; 1999-067) was accepted as a Masked Booby *sensu lato*. This record will now recirculate, along with the other previously accepted records of juveniles of this species, for evaluation of whether identification as *dactylatra* or *granti* is possible.

BROWN BOOBY *Sula leucogaster* (68, 10). Nine accepted records from 1999 (two in spring, seven in fall) were unprecedented for this species. It is unknown if the cold water experienced in 1999 had anything to do with this invasion of Brown Boobies. This was the first fall in which two different Brown Boobies were observed on Southeast Farallon I., SF, an adult male *brewsteri* 2–19 Oct 1999 (PP†, WR; 2000-017) and an adult of unknown subspecies 1–7 Nov 1999 (PC, PP; 2000-018). Peter Pyle hypothesized that the Brown Booby's recent increase in the state may be due to returning numbers of Pacific Sardines (*Sardinops sagax*). The other fall records are as follows: a second-year bird of unknown subspecies at Castle Rocks, MTY, 22–27 Jul 1999 (DR; 1999-183); an adult female of unknown subspecies at the Ventura Harbor, VEN, 7–12 Sep 1999 (RVS†; MSM, MJSM; 1999-148); an adult male *brewsteri* 10 mi SW of Pt. Loma (32° 36′ N, 117° 27′ W), SD, 11 Sep 1999 (BMu†; 1999-149); an adult female of unknown subspecies 35 n. mi. WSW of Pt. Pinos, MTY, 23 Sep 1999 (JWt†; 1999-181); and an adult male *brewsteri* at the Soquel Hole (36° 49.55′ N, 122° 4.91′ W), SCZ, 20 Oct 1999 (JB; RTe†; 1999-180). The two spring records were of an immature in the Santa Barbara Channel off Sandpiper Golf Course in Goleta, SBA, 13 Mar–*23 May* 1999 (DC, JGs, JEL, PK, CAM, GT; 1999-093) and an adult of unknown sex and subspecies from east Santa Cruz I., SBA, 8 May 1999 (DC, PK; 1999-117). The preponderance of fall records is consistent with past occurrences of this species. An immature at Pt. Loma, SD, 27–29 Sep 1997 (GMcC; 2000-046) was later captured and kept by a wildlife rehabilitator. This bird was released in south San Diego Bay sometime in the spring or summer of 1998 (fide McCaskie).

NEOTROPIC CORMORANT *Phalacrocorax brasilianus* (10, 0). An adult near Mecca, Salton Sea, RIV, 4 Jul 1999 (MAP; 1999-115) was considered a returning bird, the same as in record 1998-097 (Erickson and Hamilton 2001).

TRICOLORED HERON *Egretta tricolor* (28**, 2). An adult near Mecca, Salton Sea, RIV, 14–27 Feb 1999 (MTH, GMcC, MAP; 1999-077) and 30 Dec 1999–12 Jan 2000 (MAP; 2000-055) was considered a returning bird, the same as in CBRC 1998-048 (Erickson and Hamilton 2001). Another returning adult was at the Tijuana R. estuary, SD, 23 Oct 1999–27 Feb 2000 (GMcC; 2000-002, same as 1998-112 and 1997-184, cf. Rottenborn and Morlan 2000, Erickson and Hamilton 2001). A newly found adult was at Famosa Slough, San Diego, SD, 6–12 Jun 1999 (BMu†; 1999-168), while another adult at Pt. Sur, MTY, 24 May–2 Jun 1999 (DR†; 1999-099) was a first for the county and only the fourth for northern California.

REDDISH EGRET *Egretta rufescens* (79, 1). A returning adult was at the Tijuana R. estuary, SD, 2 Aug 1998–20 Apr 1999 (GMcC; 1999-083, same as 1997-134, cf. Rottenborn and Morlan 2000). This individual, which has a slightly deformed bill, has been wintering in the same area since first found as an adult on 18 Dec 1982. At over 17 years old, this individual continues to redefine the longevity record for this species (Clapp et al. 1982). An immature was observed near the mouth of the San Diego R., SD, 11 Aug–24 Nov 1999 (BMu; 1999-136).

BLACK-BELLIED WHISTLING-DUCK *Dendrocygna autumnalis* (16, 1). A specimen collected at Buena Vista L., KER, 19 June 1938 (#SBMNH 7202; 2001-056)

was in the Dean Hobbs Blanchard collection, which was recently donated to SBMNH. This record is predated in California only by an unreviewed 1912 record from the Salton Sea, IMP (location of reported specimen unknown) and predates the general expansion of this duck into the American Southwest.

TRUMPETER SWAN *Cygnus buccinator* (26, 2). Well-documented adults were at the Smith R. estuary, DN, 19 Dec 1999 (DFx, JCP; 1999-212) and at Pleasant Valley (Tinemaha) Reservoir, INY, 2 Jan–27 Feb, 1999 (DPa, JPa; GC, JoH†, ToH, RLd, MJM, GMcC, MSM, MAP, MMR; 1999-020). The latter bird, a wild (never translocated) female, was given green neck collar 8VO at Harriman State Park in northeastern Idaho on 7 Dec 1996. It was observed in Yellowstone National Park, Wyoming, in November and December 1997 before making its way to California in 1999. Inyo County's two earlier Trumpeter Swans had been previously translocated to Summer Lakes, Oregon (Jo Heindel in litt.).

WHOOPER SWAN *Cygnus cygnus* (6, 1). An adult at Seven Mile Lane, GLE, 1 Jan 1999 (SRE†; 1999-076) was found by birders photographing Tundra Swans (*C. columbianus*). The Committee felt that this bird, well described and photographed, was probably a wild individual, consistent with recent treatment of others of this species.

GARGANEY *Anas querquedula* (22, 1). One female was at Rodman Sough, LAK, 16–22 Oct 1999 (RiS; KKC, RKI, JWh; 1999-200). The date, though on the late side, is consistent with fall vagrants of this species.

MISSISSIPPI KITE *Ictinia mississippiensis* (28, 1). An immature at the Iron Mt. Pumping Plant, SBE, 11 Nov 1999 (BDe†; 1999-213) was astoundingly late for California, or anywhere in North America.

HARRIS'S HAWK *Parabuteo unicinctus* (6**, 2). One was along the Sweetwater R. near Spring Valley, SD, 31 Mar 1996 (PU, SCR; 1996-080IA). This record was previously accepted but was re-reviewed in light of conclusions drawn by Patten and Erickson (2000). They showed that Harris's Hawks make sporadic incursions north into California, as in the mid 1990s. After these incursions, Harris's Hawks may breed and re-establish themselves for a period of time. Nevertheless, not all records were necessarily of wild birds, as there is a background level of released or escaped birds annually. This individual was outside the invasion boundary drawn by Patten and Erickson (2000) and at the edge of metropolitan San Diego. Despite this, the previous decision (acceptance) was sustained, although not unanimously. Two to three adults were at Indio, RIV, 11–27 Nov 1999 (WJM; 1999-211). The Committee felt these were likely wild birds because of the desert locality and because multiple individuals were involved. Harris's Hawks are unusual, for raptors, in that they hunt and travel in social groups. Thus, groups or pairs in California may be more likely wild than single hawks. No documentation was received for a third bird that was reportedly present on 11 Nov 1999. Another 1999 record and three older records are still in circulation.

YELLOW RAIL *Coturnicops noveboracensis* (71, 1). One freshly killed and partially eaten carcass was found at the Smith R. Estuary, DN, 30 Oct 1999 (ADB†; 2000-052). The wings were photographed and deposited in the Humboldt State University Wildlife Museum (HSUWM #8523). It is likely that this species occurs regularly in the state, but the small size of the population, compounded by the secretive nature of this rail, accounts for its apparent rarity.

AMERICAN OYSTERCATCHER *Haematopus palliatus* (17, 1). Two juveniles were together on San Nicolas I., VEN, 7 Sep 1998, with one bird seen again 26 Sep 1998 (RAH; MAP; 1998-137). Both birds had ragged separations between the black and white on the breast, typical of the subspecies *frazari*, but one also had broad dusky edgings on the undertail coverts, possibly suggesting introgression with the

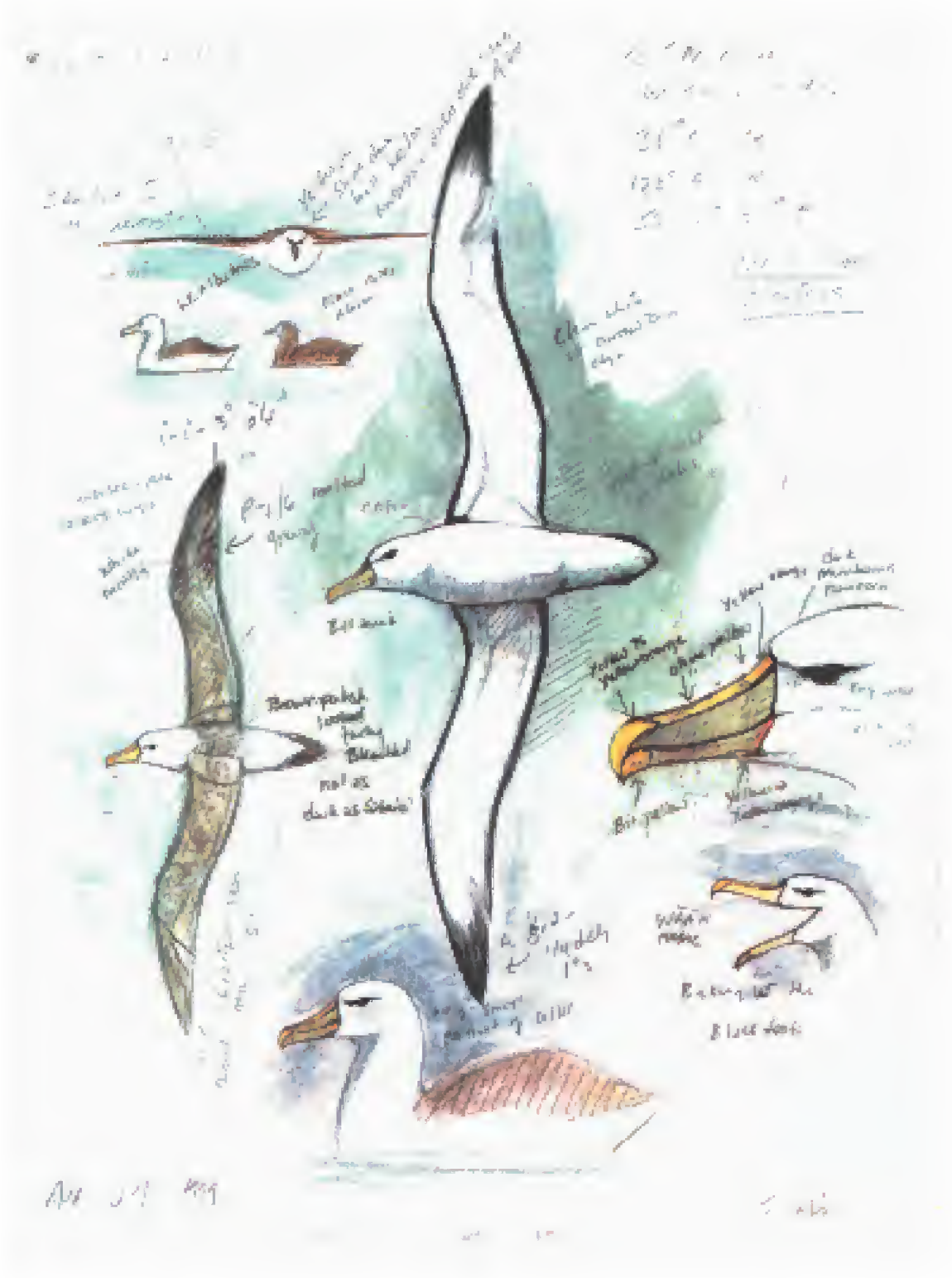


Figure 1. California's first Shy Albatross, *Thalassarche cauta*, 9 nautical miles W of Pt. Arena, Mendocino County, 24 Aug 1999 (1999-139).

Sketch by Sophie Webb

Black Oystercatcher (*H. bachmani*). After three rounds of circulation, the Committee accepted both birds, with several members suggesting they were possibly siblings. Ten of the 17 accepted records are from the Channel Islands, with five of these being from San Nicolas I.

UPLAND SANDPIPER *Bartramia longicauda* (16, 1). A juvenile at the A & G Sod Farms in San Ysidro, SD, 19–23 Oct 1999 (GMcC; GRo, MSM, LSa†, JWS†; 1999-

Figure 2. Great-winged Petrel, *Pterodroma macroptera*, 9.6 nautical miles west-northwest of Point Pinos, Monterey County, 18 Oct 1998.

Photo By Gil Ewing

177) was the first to be found in California in October. Ten of the 16 accepted records are from fall. A black-and-white photograph of this bird was published in *N. Am. Birds* 54:104.

HUDSONIAN GODWIT *Limosa haemastica* (16, 1). A juvenile was at the Eel River Wildlife Managment Area, HUM, 17–19 *Sep* 1999 (BCA†, KNN; 2000-054).

BAR-TAILED GODWIT *Limosa lapponica* (25, 2). An apparent adult was at King Salmon, HUM, 29 Aug 1999 (KNN; 2000-053), and a juvenile was seen briefly in flight over Southeast Farallon I., SF, 11 Sep 1999 (PP; 2000-019). Both showed characters of the expected Asian race *baueri*.

CURLEW SANDPIPER *Calidris ferruginea* (25, 2). Alternate-plumaged adults were at the Goleta Sewage Ponds, SBA, 10–11 Aug 1999 (DKi, JEL; KSG, RAH†, JHd†, BS; 1999-127) and Ocean Beach Park, SBA, 13–16 Aug 1999 (BrH; JC, SSo; 1999-133). The Committee did not receive photographs of the second bird, making a plumage comparison of the two birds difficult. Given that the locations are nearly 50 miles apart and that the second bird was seen later farther north (when most fall migrants should presumably be heading south), a majority of the Committee felt that the two birds were probably different individuals.

Figure 3. Fourth-winter Lesser Black-backed Gull, *Larus fuscus*, at Lake Cunningham, San Jose, Santa Clara County, 23 Feb 2000 (1999-188). Lingering signs of immaturity include extensive black in the bill, black in the tail, and reduced white mirrors on the outermost primaries, which were not completely regrown until late January.

Photo by Michael M. Rogers

Figure 4. White-winged Tern, *Chlidonias leucopterus*, molting into second winter plumage at the Moonglow Dairy, Monterey County, 7 Sep 1999 (1999-142).

Photo by John Sorensen

LITTLE GULL *Larus minutus* (76, 4). A basic-plumaged adult at the Davis Wetlands, YOL, 10–12 Mar 1999 (SHa; 1999-080), a first for the county, was considered different from the bird that showed up at the Stockton Sewage Ponds, SJ, on 15 Mar 1999. This latter bird was joined by another adult on 14 Apr 1999, and both remained until 12 May 1999, with one of the two still present the next day (SAb; KBu, LCo, EG†, CL, LML‡, JDP; 1999-082). Videotape taken 25 Apr 1999 confirms that one bird had already acquired a full black hood on this date, while the other retained mostly basic plumage. Eight days later, the two birds seen and photographed both had black hoods, one with "slight white flecks." The rapidity of this molt led some members to speculate that there may have been three birds. A first-summer bird was at the SE end of the Salton Sea, IMP, 23 May–6 Jun 1999 (MAP†; GMcC, KZK, MBS†; 1999-098). Most wintering birds depart by early May, and the few late May records for the state usually pertain to first-summer birds, which may oversummer while molting to second basic plumage. Although several such records have come from the Salton Sea, the above bird was not refound after 6 June. A black-and-white photograph was published in *N. Am. Birds* 53:329.

LESSER BLACK-BACKED GULL *Larus fuscus* (18, 1). Returning adults included one that spent a second winter at the Whitewater R. delta, Salton Sea, RIV, 26 Jan–

Figure 5. Immature Gray-cheeked Thrush, *Catharus minimus*, banded at Southeast Farallon Island, San Francisco County, 10 Sep 1999 (2000-020). Measurements apparently rule out the similar Bicknell's Thrush, *C. bicknelli*.

Photo by Ivan Samuels

Figure 6. Immature Connecticut Warbler, *Oporornis agilis*, at the Point Reyes lighthouse, Marin County, 3 Oct 1999 (1999-162). Note the chunky, short-tailed build, the heavy bill, and the complete broad buffy-white eyering.

Photo by Les Chibana

27 Feb 1999 (MAP†; MTH, GMcC; 1999-050, same as 1998-049, Erickson and Hamilton 2001) and another that spent a fifth winter at Alviso, SCL, 16 Oct 1999–3 Feb 2000 (SCR; AJ, NL; 2000-140, same as 1998-203, Erickson and Hamilton 2001). Another adult was along the Santa Ana R., ORA, 13–14 Feb 1999 (VH; SSo; 1999-073). A bird that spent a third winter at L. Cunningham in San Jose, SCL, 1 Nov 1999–26 Mar 2000 (MMR†; WGB, JMo, BP, MW; 1999-188, same as 1999-001, Erickson and Hamilton 2001; Figure 3) was in its fourth winter, despite retaining black smudges on the bill and tail into spring.

It should be noted that the dark-backed Asian subspecies *heuglini* and *taimyrensis*, formerly considered part of the Herring Gull (*L. argentatus*) complex (e.g., Grant 1986), are now treated by the AOU (1998) as subspecies of the Lesser Black-backed Gull. As with many previous California records of this species, not all Committee members were convinced that the four birds above could be assigned definitively to *L. f. graellsii* rather than to either of these Asian taxa (see also discussions by Rottenborn and Morlan 2000 and Erickson and Hamilton 2001). For example, the bird at L. Cunningham, like some previous California Lesser Black-backed Gulls, was still regrowing its outermost primaries in mid-January, a molt timing similar to that reported for *heuglini* (e.g., Kennerly et al. 1995, Rauste 1999) and different from that of European *graellsii* (Jonsson 1998). However, apparent Lesser Black-backed Gulls in the eastern United States have shown a similar delayed molt (Martin Reid pers. comm.), suggesting that molt timing in North America may be different from that in Europe.

BRIDLED TERN *Sterna anaethetus* (1, 0). An adult at Bolsa Chica, ORA, 10 Jul 1999 (JEP; DRW; 2000-063) was considered to be the same individual that was there 17 Jul 1998 (1998-105, Erickson and Hamilton 2001). This remains one of only four species on the state list supported by written documentation only.

SOOTY TERN *Sterna fuscata* (7, 1). A pair at the salt works north of Imperial Beach, SD, 15 Apr–10 Jun 1997 (GMcC, #SDNHM 49966 and 49807; 1997-103) incubated a single fertile egg 3–10 Jun. This breeding effort failed when the birds suffered predation on 6 June (male) and 10 June (female), apparently by a Peregrine Falcon (*Falco peregrinus*) (Smith 1999). What was presumably the same pair had been seen the previous year on 23 Aug 1996, at the same location and by the same Fish & Wildlife Service personnel who discovered the nest in 1997.

WHITE-WINGED TERN *Chlidonias leucopterus* (2, 1). A bird molting from first summer to second winter plumage was at the Moonglow Dairy, MTY, 4 Sep–16 Oct 1999 (EK†; RLB†, KBu, MD‡, JLD, RF, KKw, DLa, LML‡, JMi, GMcC, JMo, MAP, BP, DEQ, DR†, MMR†, JSo†, SBT, DT; 1999-142; Figure 4). Initially called a Black Tern (*C. niger*), this bird was not correctly identified until 6 Sep 1999, and a Black Tern reported at this location as early as 17 Aug 1999 may have been this bird. It represents the second record for California and for the west coast south of Alaska. A black-and-white photograph of this bird was published in *N. Am. Birds* 54:101.

THICK-BILLED MURRE *Uria lomvia* (37, 2). An alternate-plumaged adult was 0.3 mile off the Santa Cruz lighthouse (36° 56.91′ N, 122° 1.22′ W), SCZ, 17 Oct 1999 (SBT; 2000-060), and a basic-plumaged bird was 0.5 mile off the Pt. Sur lighthouse, MTY, *19* Sep 1999 (CrH, GE†; 1999-207). Another record from Santa Cruz County on 4 Oct 1999 is still under review.

LONG-BILLED MURRELET *Brachyramphus perdix* (6, 3). Three specimen records of alternate-plumaged adults found dead at Mono L., MNO, 9 Aug 1981 (#SDNHM 41544; 2000-041), 2 Aug 1983 (#MVZ 169134; 2000-009), and 6 Aug 1983 (#UMMZ 224652; 2000-067) double the number of accepted state records of this recently recognized species. Another Mono L. specimen from 29 Jul 1983 is still being reviewed. These records, including a photograph of the second specimen listed above, were discussed by Jehl and Jehl (1981) and Sealy et al. (1991). Mlodinow (1997) and Lethaby (2000) summarized criteria for the species' identification.

PARAKEET AUKLET *Aethia psittacula* (70, 2). Single adults were 34 n. miles WSW of Southeast Farallon I. (37° 33.8′ N, 123° 32.1′ W), SF, 20 Feb 1999 (SCR, IG, GRe; 1999-125) and 23 n. miles SW of Southeast Farallon I. (37° 24.9′ N, 123° 18.3′ W), SF, 23 Feb 1999 (SCR, IG; 1999-126). Despite the infrequency with which this species is detected off California, many believe that it is probably regular far offshore, at least in most winters.

RUDDY GROUND-DOVE *Columbina talpacoti* (70, 1). A male was photographed at a back yard feeder in Santee, SD, 16 May 1999 (BMu; 1999-103). This species has been observed much less frequently in California in recent years, with 56 records from 1988 to 1993 being followed by only 9 records from 1994 through 1999.

SNOWY OWL *Nyctea scandiaca* (69**, 0). Three specimens of adults taken during the 1916 invasion included a female from Ocean Beach near the outlet of L. Talawa, DN, 14 Nov 1916 (#MVZ 27138; 2000-010), a female from Crescent City, DN, 25 Nov 1916 (#MVZ 27140; 2000-012), and a male from J. L. Moxon's ranch in the Arcata Bottoms, HUM, 30 Dec 1916 (#MVZ 27584; 2000-011). This invasion accounts for 21 of the 69 records since 1900. All three of these records were previously accepted for statistical purposes based on their inclusion by Grinnell and Miller (1944), but this is the first time that the specimen evidence was reviewed by the Committee. The Snowy Owl has not occurred in California since 1978.

BROAD-BILLED HUMMINGBIRD *Cynanthus latirostris* (55, 1). A vocal adult male at the town of Big River, SBE, 4 Sep 1999 (BMu; 1999-150) was the earliest in fall in California by two days. There are no accepted records between 18 April and 4

September.

VIOLET-CROWNED HUMMINGBIRD *Amazilia violiceps* (5, 1). One in Westhaven, HUM, 17–23 Sep 1999 (DFx, RLeV†; 1999-155) was only the fifth for California and also the state's northernmost by 200 miles. The five accepted records form little pattern, spanning the length of the state and eight months of the year. A color photograph of this bird was published in *N. Am. Birds* 54:116.

RED-HEADED WOODPECKER *Melanerpes erythrocephalus* (5, 1). An adult near the fish docks on Pt. Reyes, MRN, 17 Jul 1999 (JSm†; 2000-079) constituted only the fifth record for California. Despite extensive searching, the bird could not be relocated after being seen flying from telephone pole to telephone pole toward the Nuñez Ranch. The five accepted records are scattered throughout the state between 20 May and 22 August, except for a wintering bird 14 Sep 1988–23 Apr 1989 in Goleta, SBA (Pyle and McCaskie 1992).

GREATER PEWEE *Contopus pertinax* (33, 1). One found on the Malibu Christmas bird count in Chesebro Canyon, LA, remained for a month, 19 Dec 1999–19 Jan 2000 (RBe; KLG†, KKw; 2000-026). The rectrix shape visible in one photograph suggests that the bird was in its first winter (Pyle 1997a).

YELLOW-BELLIED FLYCATCHER *Empidonax flaviventris* (13, 1). The documentation of an immature at the Iron Mt. Pumping Plant, SBE, *18* Sep 1999 (MAP†; 1999-156) was adequate to confirm the identification, even though no vocalizations were heard. Separation of this species from the similar Pacific-slope Flycatcher (*Empidonax difficilis*), as well as other cogeners, was discussed by Heindel and Pyle (1999). Of the 13 accepted records, which range from 3 September to 16 October, five each are from Kern County and Southeast Farallon I.

DUSKY-CAPPED FLYCATCHER *Myiarchus tuberculifer* (55, 3). One was along Lobitos Creek, SM, 14 Feb 1999 (RST; 1999-088). Another along Carpinteria Creek, SBA, *12–13* Apr 1999 (BHa, JEL; 1999-118) may have been reported as an Ash-throated Flycatcher (*M. cinerascens*) nearby on 24 Feb 1999 and as a "possible" Dusky-capped Flycatcher on *13* Mar 1999, especially since all previous April records have been thought to be wintering birds. A description from 30 May 1999 of a silent *Myiarchus* thought to be this bird was insufficient to establish what would be the latest spring record for California. No documentation was received for a report from 22 May, which would likewise have been the latest spring record ever. A third bird was at Ole Hammer Park in Glendora, LA, *12* Dec 1999–7 Jan 2000 (JBr; KLG, KSG, MJSM; 1999-209). All three of these birds were heard to give the plaintive "peeur" call diagnostic of this species.

GREAT CRESTED FLYCATCHER *Myiarchus crinitus* (43, 1). A vocal immature was at the Carmel R. Mouth, MTY, 16–19 Sep 1999 (JLD, JMo, DR, SBT†; 1999-163). The accepted records are all from fall, 4 Sep–2 Nov, with the vast majority being from coastal counties from Marin south.

SULPHUR-BELLIED FLYCATCHER *Myiodynastes luteiventris* (14, 1). An immature was along Pescadero Creek, SM, 18–20 Sep 1999 (RST; DJP‡; 2000-034). The previous San Mateo record, 14 Jun 1998 (Erickson and Hamilton 2001), is the only one outside the fall date range 13 Sep–20 Oct. There are still no accepted records of this species from the interior of California.

THICK-BILLED KINGBIRD *Tyrannus crassirostris* (15, 1). An adult returned to the campus of California State Polytechnic University, Pomona, LA, for its eighth winter, 2 Nov 1999–2 Mar 2000 (KLG, GMcC, JMo, MJSM; 1999-196, same as 1998-175, Erickson and Hamilton 2001), and another returned to the Ocean Colony Golf Course in Half Moon Bay, SM, for its second, 18 Dec 1999–27 Mar 2000 (RF,

Figure 7. Immature female Snow Bunting, *Plectrophenax nivalis*, at Clam Beach, Humboldt County, 14 Nov 1999 (2000-077). The age and sex can be determined from the extensive black in the outer greater coverts and primary coverts, along with the narrow, tapered shape of the outer primary coverts and tapered outer rectrices.

Photo by Brian C. Acord

AJ, JMo; 2000-065, same as 1998-233, Erickson and Hamilton 2001). A bird of unknown age was at the River View Ranch in Santa Paula, VEN, *23* Feb–3 Mar 1999 (SHe‡; 1999-086). The last, a first for the county, was videotaped by the landowner, who recognized it as something out of the ordinary despite being unable to identify it.

*SCISSOR-TAILED FLYCATCHER *Tyrannus forficatus* (101, 1). Photographs of an apparent adult male in Torrance, LA, 7 Jun 1989 (MiH†; 1991-035A) were recirculated with additional documentation substantiating the circumstances of this record. The Committee regrets that this record was previously not accepted (Patten and Erickson 1994) owing to the Committee's failure to follow up on questions about the documentation originally submitted for review. Records of this species after 1997 are no longer reviewed.

WHITE-EYED VIREO *Vireo griseus* (39, 1). A singing male was at California City, KER, 29 May 1999 (MTH; KSG, DSt; 1999-107). All but eight of the accepted records are from spring, of birds arriving between 8 May and 27 Jun.

YELLOW-THROATED VIREO *Vireo flavifrons* (74, 5). Spring migrants were in Jawbone Canyon, KER, 26 May 1999 (MTH†; 1999-106), the first for the Kern desert, and at Lone Pine, INY, 27 May 1999 (DSd; 1999-119). A worn first-summer bird banded at the Big Sur R. mouth, MTY, 28 Jul 1999 completed its prebasic molt while summering through 17 Sep 1999 (JLD, KKw, DR†; 1999-145), establishing the first record of a live bird for Monterey County. In fall, one was at Galileo Hill Park, KER, 9 Oct 1999 (VH; KSG, AH; 2000-044) and another was at the Carmel R. mouth, MTY, 15–23 Oct 1999 (DR; 1999-182). No documentation was received for

two other 1999 records, one in the San Bernardino Mts., SBE, on 2 May and another at Olema Marsh, MRN, in "early" September.

BLUE-HEADED VIREO *Vireo solitarius* (6**, 1). An immature photographed and banded at Southeast Farallon I., SF, 14 Sep 1999 (RDB, IS†; 2000-015) represents the earliest accepted record by two weeks. Early September reports of this species are often thought to pertain to bright Cassin's Vireos (*V. cassinii*), as *solitarius* migrates late in the East. This record indicates, however, that this species can appear in California by mid-September. The identification of this recently recognized species was covered by Heindel (1996). Unsupported reports of this species continue to cloud its status in California (e.g., only two of seven northern California reports from 1999 were documented, *N. Am. Birds* 54:102).

YELLOW-GREEN VIREO *Vireo flavoviridis* (66, 3). An immature was at Pt. Loma, SD, 17 Sep 1999 (GMcC; 1999-167). Recently accepted older records include a bird caught by a domestic cat in San Diego, SD, 16 Sep 1996 (#SDNHM 50241; 2000-014) and another at Andrew Molera State Park, MTY, 1 Oct 1997 (JLD, KLG; 2001-046). Three other records from 1999 failed to garner acceptance (see below). The single accepted record from 1999 was well below the yearly average of six from 1995 to 1998. All accepted records are from fall, 6 Sep–30 Oct, and all but four are from coastal counties.

GRAY-CHEEKED THRUSH *Catharus minimus* (21, 1). An immature banded on Southeast Farallon I., SF, 10 Sep 1999 remained on the island through 16 Sep 1999 (PP, IS†; 2000-020; Figure 5). The measured wing cord of 99 mm is slightly longer than the maximum for Bicknell's Thrush (*C. bicknelli*) listed by Ouellet (1993), although the tail length of 65 mm is at the low end for both species, perhaps suggesting a female. All but two of the accepted records are from fall, 10 Sep–31 Oct; eleven are from Southeast Farallon I., with four more from nearby Pt. Reyes, MRN.

WOOD THRUSH *Hylocichla mustelina* (15, 1). One at Galileo Hill Park, KER, 16 Jun 1999 (KSG; CAM; 1999-114) was California's fifth in spring. All spring records are between 2 and 19 June.

RUFOUS-BACKED ROBIN *Turdus rufopalliatus* (9, 1). One spent a week at Furnace Creek Ranch, INY, 20–27 Nov 1999 (JLD, JoH†, ToH, RHu, GMcC, MJSM, MSM†; 1999-195). Six of the nine accepted records are from interior counties; all are of late fall/wintering birds, 5 Nov–13 Apr.

*GRAY CATBIRD *Dumetella carolinensis* (106, 5). In spring, one was at Marion Bear Park, San Clemente Canyon, San Diego, SD, 27 Apr 1999 (MBS; 1999-102). In fall, one was at Galileo Hill Park, KER, 29 Sep–6 Oct 1999 (KSG; JLD, MPo†; 2000-045), one was along Sinclair Road near the SE end of the Salton Sea, IMP, 26 Oct 1999 (MFl; 1999-174), one was in the Saline Valley, INY, 11 Nov 1999 (REM; 2000-007), and one was in Claremont, LA, 18 Nov 1999 (CB; 1999-204). Records after 1999 will not be reviewed.

BLUE-WINGED WARBLER *Vermivora pinus* (29, 3). Singing males, both apparently in their first summer, were west of Santa Rosa, SON, 2 Jun 1999 (DWN†; 1999-131) and at Butterbredt Springs, KER, 8–10 Jun 1999 (VH; KSG, MTH†; 1999-108). Another bird, also reported as a male, was at Pt. Loma, SD, *30 Sep* 1999 (JW, TP; 1999-161). Accepted records for California are split nearly equally between spring (15 between 9 May and 27 June) and fall (13 between 31 August and 2 October), with one wintering record from Humboldt County.

YELLOW-THROATED WARBLER *Dendroica dominica* (87, 2). One at Skylawn Memorial Park Cemetery along Highway 92, SM, 19 Jun 1999 (RST; 1999-135) and another in Huntington Beach, ORA, 6 Nov 1999–2 Apr 2000 (MD‡, JLD, KLG,

KSG, KKw, CAM, JMo, MJSM, MSM†, JWb†; 1999-197) were both apparently of the white-lored race *albilora*. Although this is the expected race during migration, the previous two wintering birds showed characteristics of the nominate subspecies *dominica*, as discussed by Dunn (1988) and Garrett and Singer (1998).

PINE WARBLER *Dendroica pinus* (58, 2). An immature female was at Goleta, SBA, 29 Dec 1999–21 Jan 2000 (KBr; DC, AME; 2000-037), and another apparent immature wintered at El Dorado Park in Long Beach, LA, 25 Nov 1999–28 Feb 2000 (KSG; JMo, MJSM, MSM†; 1999-203). This marks the third year in a row that this species has wintered at El Dorado Park; however, all these birds were thought to be immatures and therefore presumed to be different individuals.

WORM-EATING WARBLER *Helmitheros vermivorus* (87, 2). One wintered in Huntington Beach, ORA, 16 Oct 1999–22 Feb 2000 (CAM, MD‡, KLG, KSG, KKw, GMcC, JMo, MJSM, MSM; 1999-190). A second bird found wintering in the same park on 2 Jan 2000 will be discussed in the next report. An additional previously unpublished report of a bird seen in Pacific Grove, MTY, 21 Oct 1972 (BRe; 1996-065) was accepted "for statistical purposes" (see Roberson 1986) at the Committee's 1999 annual meeting. Such acceptance usually applies to older records (prior to 1980) for which documentation is no longer available but have been published in an authoritative source and are thought to be correct.

LOUISIANA WATERTHRUSH *Seiurus motacilla* (10, 2). A briefly seen but well described individual was at the Iron Mt. Pumping Plant, SBE, 28 May 1999 (MAP; 1999-112), and an immature was at Panamint Springs, INY, 24–25 Sep 1999 (SBT†; JLD, RF, JoH†, GMcC, MSM, JMo; 1999-159). The latter is the fourth for fall and the latest by one week. Seven of the ten accepted records are from the interior of southern California.

CONNECTICUT WARBLER *Oporornis agilis* (82, 3). An immature female was banded on Southeast Farallon I., SF, 23 Sep 1999 (PP, IS†; 2000-022), and another individual was seen briefly at the same location on 1 Oct 1999 (PP; 2000-023). Feathers from the latter, apparently the victim of a Sharp-shinned Hawk (*Accipiter striatus*), were found on 2 Oct 1999 (#CAS 88970). A very cooperative immature was at the Pt. Reyes lighthouse, MRN, 2–4 Oct 1999 (LCh†, GE†, RF, LF†, NLe, JMo, KS; 1999-162; Figure 6). Two other records from the fall of 1999 are still circulating. These two locations are popular with this species; 47 accepted records are from Southeast Farallon I., and an additional nine are from Pt. Reyes.

MOURNING WARBLER *Oporornis philadelphia* (109, 4). Two were banded on Southeast Farallon I., SF, 4 Sep 1999 (IS†; 2000-021) and 15 Sep 1999 (RDB, IS†; 2000-016). The first was thought to be an adult female despite reportedly having an incompletely pneumatized skull; the second was an immature female. Immatures were also found at Tunitas Creek, SM, 12 Sep 1999 (RST; 2000-033) and at Pt. Pinos, MTY, 11–12 Sep 1999 (SBT; DR; 1999-184). Two other records from the fall of 1999 are still circulating. Although other species observed with comparable regularity in California have been removed from the review list, the Mourning Warbler remains on this list in part because of the difficulty in identifying this species confidently and in part because of continued uncertainty about its status on the mainland (51 of the 109 accepted records are from Southeast Farallon I.; see also Rottenborn and Morlan 2000).

RED-FACED WARBLER *Cardellina rubrifrons* (12, 1). One discovered at Twentynine Palms, SBE, 16 Jun 1993 was found dead the next day (#SBCM 54100; 2001-023). All but two of the twelve accepted records are of spring birds first detected between 13 May and 17 June.

SCARLET TANAGER *Piranga olivacea* (101, 2). Immature males, with fresh black

wing coverts contrasting with duller remiges, were found along Marshall Beach Road, MRN, 28 Nov 1999 (KS; 1999-206) and at Galileo Hill Park, KER, 18 Oct 1999 (MTH; 1999-187). Prior to the Marin record there were already 32 accepted records from November, but only two of these were from northern California (both from Southeast Farallon I.). Only two birds (both in San Luis Obispo Co.) have remained into December.

LE CONTE'S SPARROW *Ammodramus leconteii* (29, 1). One was at Furnace Creek Ranch, INY, 3 Oct 1999 (TEW; 2000-027). Furnace Creek Ranch and Southeast Farallon I. each claim eight fall records, spanning 3 Oct–5 Nov and 11 Sep–27 Oct, respectively. However, Furnace Creek's two late May records make it the most frequent location for this species in California.

*NELSON'S SHARP-TAILED SPARROW *Ammodramus nelsoni* (26, 0). A singing bird at the Palo Alto Baylands, SCL, 23 Apr 1979 (WGB) was taken to be the bird that wintered there 25 Jan–24 Feb 1979, thereby extending the late date of record 1979-014 (Luther et al. 1983) by two months. Few of our coastal wintering birds are detected this late in the year, although there are five records of spring migrants in the interior (Mono, Inyo, and Kern counties) 13–29 May. Records of this species after 1986 are not reviewed.

SNOW BUNTING *Plectrophenax nivalis* (68, 4). A diagnostic photograph of an immature female at Clam Beach, HUM, 14–15 Nov 1999 (BCA†; 2000-077; Figure 7) was received without an accompanying description. Two others seen only in flight on Southeast Farallon I., SF, 28 Oct 1999 (IS; 2000-024) and 6 Nov 1999 (SAn; 2000-025) made the 13th and 14th accepted records for the island, all falling between 22 October and 18 November. Another was seen along the coast near the mouth of Purisima Creek, SM, 7 Nov 1999 (RST; 2000-035).

PYRRHULOXIA *Cardinalis sinuatus* (20, 1). An adult male in Yucca Valley, SBE, 31 Jul 1999 (ZA†; 1999-130) fit the predominant pattern of spring and summer birds in the southern deserts and was accepted unanimously. Another 1999 record, of a bird that wintered in urban Costa Mesa, ORA, continues to circulate because of greater concerns about natural occurrence (the species is known to be kept in captivity in Mexico and may also be held in southern California).

PAINTED BUNTING *Passerina ciris* (73, 9). Of eight 1999 records reviewed, six of females or immatures were unanimously judged to be of natural occurrence. These were at the Carmel R. Mouth, MTY, 19 Sep 1999 (SRv, BaM; 1999-185), at Furnace Creek Ranch, INY, 2 Oct 1999 (JoH; TEW; 1999-175A) and 20–23 Oct 1999 (MJSM; TEW; 1999-175B), at Galileo Hill Park, KER, 11–12 Sep 1999 (MTH; 1999-186), along Atascadero Creek, Goleta, SBA, 31 Aug–1 Sep 1999 (GT, DC; 1000-029), and in Morongo Valley, SBE, 7 Sep 1999 (JLD; 2001-047). A majority of the Committee questioned the natural occurrence of a winter pair, and another record of a single bird was insufficiently documented to establish the identification (see below). Older records of a female or immature on Southeast Farallon I., SF, 21 Oct 1997 (WR; 2000-083) and of an apparent immature at Furnace Creek Ranch, INY, 24 Sep 1994 (BED; GMcC; 1994-151) were also unanimously accepted as pertaining to naturally occurrences, fitting the pattern of mostly young birds in fall.

The status of the Painted Bunting in California is clouded by released or escaped cage birds from Mexico, where this species is commonly held in captivity, and possibly southern California, where they have occasionally been observed for sale. In an attempt to shed light on persistent controversy surrounding California Painted Bunting records, Hamilton decided to reexamine all the state records of this species (cf. Erickson and Hamilton 2001). On his recommendation, the CBRC reassessed several older Painted Bunting records. These included three spring records, of a singing first-summer male west of Santa Rosa, SON, 24 Jun 1966 (#CAS 69789;

1985-139, Roberson 1993), an adult male at Oasis, MNO, 23 May 1986 (1986-262, Bevier 1990), and an adult male at Scotty's Castle, INY, 22 May 1987 (1987-138, Langham 1991). Each remained accepted, with votes of 8–2 in the second round of recirculation in all three cases. All Committee members believe that natural spring vagrants of this species are possible in California, especially in light of their occurrence elsewhere in the United States, and most feel that this likelihood is great enough to warrant acceptance of these records. Another older record, of an adult male at Atascadero Creek, Goleta, SBA, 5–10 Sep 1995 (1996-059, McCaskie and San Miguel 1999) was originally not accepted because of questionable natural occurrence, but this decision was overturned after two circulations through the Committee, with the record being accepted 9–1. This bird's worn appearance, originally interpreted as probable cage wear, is now known to be normal for adults in early fall (Pyle 1997a), and all other circumstances of this record were consistent with a naturally occurring vagrant at a known vagrant trap. Other accepted fall records of adult males are from Furnace Creek Ranch, INY, 4 Nov 1972 (Roberson 1986), Hole-in-the-Wall, SBE, 2–5 Sep 1993 (Howell and Pyle 1997), and Twentynine Palms, SBE, 8 Oct 1998 (Erickson and Hamilton 2001). Further compounding the difficulty of assessing this bird's status in California, noncontroversial records of Painted Buntings have exploded in California in recent years (*N. Am. Birds* 55:101-105).

COMMON GRACKLE *Quiscalus quiscula* (48, 4). Males were seen at Cow Creek in the Furnace Creek Ranch area of Death Valley National Monument, INY, 2 Oct 1998 (JLD; 2001-048), in Lompoc, SBA, 3 Jan–4 Mar 1999 (BrH†; GL; 1999-100), near Kettleman City, KIN, 1 Mar 1999 (JSy; 1999-079), and at Panamint Springs, INY, 24 Apr 1999 (CrH; 1999-094). Twenty of the accepted records are from Inyo Co., with 10 more from adjacent inland counties.

BLACK ROSY-FINCH *Leucosticte australis* (8, 1). A specimen of an adult female was obtained at Bodie, MNO, 22 Nov 1968 (#MVZ 159188; 2000-013). Six of the accepted records are from Inyo Co., the other two from Mono. Four other specimen records from these same two counties have yet to be reviewed. Each of these 12 records falls between 11 and 28 November or 31 March and 5 April, except for single records from January and February.

POPULATIONS ACCEPTED

In addition to evaluating and archiving records of birds that rarely occur in California, the Committee also maintains a state bird list, which includes introduced species considered to be established in the state. For a species to be added to the state list, the identification must be established and the population in the state must be considered "viable." The Committee's criteria for viability are (1) that the species has bred in the state for 15 consecutive years, (2) that the population is increasing or stabilized after an initial period of increase, (3) that the species occupies enough geographically contiguous suitable habitat that the population is unlikely to diminish significantly, and (4) that the occupied environment is ecologically similar enough to the species' native habitat, or to that of other successful introductions, that permanent establishment seems likely. Populations maintained primarily by continued releases or requiring intense management are not considered viable.

*RED-CROWNED PARROT *Amazona viridigenalis*. A comprehensive listing package put together by the Introduced Birds Subcommittee (Kimball Garrett, chairman, Joseph Morlan, and Mike San Miguel; 2001-032; Figure 8) was unani-

mously judged to demonstrate adequately that the Red-crowned Parrot qualifies for addition to the state list. This species joins the Chukar (*Alectoris chukar*), Ring-necked Pheasant (*Phasianus colchicus*), White-tailed Ptarmigan (*Lagopus leucurus*), Wild Turkey (*Meleagris gallopavo*), Rock Dove/Feral Pigeon (*Columba livia*), Spotted Dove (*Streptopelia chinensis*), European Starling (*Sturnus vulgaris*), and House Sparrow (*Passer domesticus*) as the ninth introduced species on the state list. In the future, the Committee anticipates considering other parrot species and perhaps the Nutmeg Mannikin (*Lonchura punctulata*) and Orange Bishop (*Euplectes franciscanus*) for possible inclusion on the state list as well.

The Red-crowned is the most numerous parrot in California, with population estimates in excess of 2000 birds (Garrett 1997, in litt., Mabb 1997a, b), perhaps representing up to 20% of the world's free-flying population of this species (Birdlife International 2000). This population continues to grow at a rapid rate, with flocks containing up to 50 dependent young in the Temple City/Arcadia area alone each year (Mabb 1997b). The species now occurs throughout the San Gabriel and San Fernando valleys, LA, and urban portions of Orange Co., with smaller numbers in adjacent San Bernardino, Riverside, and San Diego counties. It is unclear whether smaller populations of *Amazona* parrots in northern California, Palm Springs, and other urban southern California locations are self-sustaining and whether they are all of this species.

The identification of this parrot has been established by specimens (#LACM 106053, 110291, 110292, 110428; 2001-032) and photographs. A few birds show signs of introgression with the Lilac-crowned Parrot (*A. finschi*), including perhaps LACM 110292, and mixed breeding pairs of these species have been observed (Mabb 1997b), but such circumstances appear limited. Karen Mabb has

Figure 8. Red-crowned Parrot, *Amazona viridigenalis*, collected at Temple City, Los Angeles County, 21 April 1998 (#LACM 110428; 2001-032).

Photo by Kimball L. Garrett

documented breeding by Red-crowned Parrots in Temple City and adjacent areas since 1995 (Mabb 1997b). Documentation of earlier breeding is less systematic, but Froke (1981) reported nesting in the San Gabriel Valley during his 1976–1978 field work, apparently as a result of releases in this area in the 1950s. Despite no known documentation of successful breeding by the species in the 1980s, the Committee inferred that such breeding had indeed occurred and that the criterion of breeding for 15 consecutive years had been met.

Red-crowned Parrots have adapted well to California's urban and suburban environments, exploiting a variety of foods (Garrett et al. 1997) and selecting nest sites similar to those in the bird's native range. The species has already been added to the Texas list by the Texas Bird Records Committee. In Texas the species occupies similar urban habitats, albeit of more limited extent. Given the proximity of naturally occurring Red-crowned Parrots, the Texas committee was unwilling to comment on the origin of Texas birds, stating that this parrot was a "well-established species, whether as a result of natural occurrence, introduction, or both" (Haynie 1996). Although the California birds are clearly a result of releases, they appear equally able to establish self-sustaining urban populations.

RECORDS NOT ACCEPTED, IDENTIFICATION NOT ESTABLISHED

MANX SHEARWATER *Puffinus puffinus.* One observed during a seawatch from Pigeon Pt., SM, 20 Mar 1999 (1999-109) was likely correctly identified, but the report lacked details sufficient to eliminate other species, particularly given the spring date. Three fall records, likewise inadequately documented, included one from Southeast Farallon I., SF, 21 Sep 1997 (2000-084), one 15 miles NNW of Pacific Grove, SCZ, 7 Oct 1999 (1999-164), and one from Monterey Bay, MTY, 26 Aug 1999 (1999-137). These reports suffered from brief descriptions that did not address all of the critical field marks of this species, failing to eliminate Townsend's (*P. auricularis*) and other shearwaters from consideration.

WEDGE-RUMPED STORM-PETREL *Oceanodroma tethys*. Documentation for a storm-petrel seen approximately 33 miles SW of San Miguel Is., SBA (33° 34.07' N, 120° 49.57' W), SBA, 6 Sep 1997 (1997-137†; Figures 9 and 10) was extremely difficult for the Committee to evaluate. The written descriptions read very well for a Wedge-rumped Storm-Petrel, but problems arose from apparent inconsistencies between them and an extensive series of photographs, which were not quite crisp enough to clinch the identification. For example, some members thought that the enlarged look to the white rump was due to the photos' blurriness. Others thought that apparent yellowish color visible near the tail may have been the bird's feet, as shown by Wilson's Storm-Petrel (*Oceanites oceanicus*), although this color was eventually written off by most members as a photographic aberration, exaggerated in scans of the original slides. The tail appears asymmetric in some photos, suggesting that molt may have given another storm-petrel species the short-tailed look (relative to the uppertail coverts) expected of a Wedge-rumped Storm-Petrel. It was generally recognized that the extent of white on the rump was at the low end for this species, while the amount of black tail visible beyond the white uppertail coverts was at the high end. The bent-winged structure and the long "hand" shown by this bird are unlike the wing shape of a Wilson's and more like that of a Wedge-rumped or Leach's (*Oceanodroma leucorhoa*). The white "wrap-around" extending from the rump to the sides of the undertail coverts matched photos of Wedge-rumped Storm-Petrels from the eastern tropical Pacific very closely, if not exactly. Although most members thought that the described size and extent of white on the rump and undertail coverts was incorrect for a Leach's Storm-Petrel, that species is the most variable Pacific storm-petrel, leaving room for uncertainty. Additionally, the small subspecies *O. l.*

Figure 9. Possible Wedge-rumped Storm-Petrel, *Oceanodroma tethys*, 33 miles southwest of San Miguel Island, Santa Barbara County, 6 Sep 1997 (1997-137). Although slightly atypical in shape for this species, the white rump patch was likely too extensive for a Wilson's Storm-Petrel (*Oceanites oceanicus*), a species which would have also shown a more rounded wing shape.

Photo by Ronald M. Saldino

socorroensis is essentially identical in size to the Wedge-rumped (Naveen 1976). Voting was divided throughout the four rounds, and many members changed their minds as more analyses and comments on the identification came forward. Although the final vote was evenly split, keeping this record from being endorsed, the bird may well have been correctly identified. Members with the most experience with this species, as well as outside seabird experts, felt that the bird was, indeed, probably a Wedge-rumped Storm-Petrel.

ANHINGA *Anhinga anhinga*. A report from Decker Canyon Road, LA, 11 Nov 1999 (1999-214) was consistent with a worn immature Double-crested Cormorant (*Phalacrocorax auritus*).

ROSEATE SPOONBILL *Ajaia ajaja*. A report of three individuals from the Wister Unit, Salton Sea, IMP, 30 Mar 1999 (1999-091) was troublesome; while the description was perhaps adequate for this species, it left enough doubt to deter the Committee from accepting the record. Escaped Chilean (*Phoenicopterus chilensis*) and Lesser (*Phoeniconaias minor*) flamingos continue to be observed at the Salton Sea, and CBRC members thought that these birds may have been involved.

TRUMPETER SWAN *Cygnus buccinator*. A mixed group of Trumpeter and Tundra (*C. columbianus*) swans was reported flying over Staten I., SJ, 22 Jan 1999 (1999-049). The calls were described as being different from those of Tundra Swans, but the vocal description was less than diagnostic. A bird heard, but not seen, in fog at the Cosumnes R. Preserve, SAC, 24 Jan 1999 (1999-085) was not endorsed, with one member suggesting that the Whooper Swan (*C. cygnus*) was not eliminated. The

Figure 10. The same storm-petrel shown in Figure 9. The apparent extent of the white "wrap-around" from the rump onto the sides of the undertail coverts in this photograph matches well that of known Wedge-rumped Storm-Petrels from the eastern tropical Pacific.

Photo by Ronald M. Saldino

details in a report from Modoc N. W. R., MOD, 8 Mar 1999 (1999-084), involving eight birds flying over and calling, were not adequate to confirm the identification. Another report was of a bird flying in a flock of Tundra Swans and calling from the Bobelaine Wildlife Sanctuary, SUT, 19 Dec 1998 (1999-019). While most members felt that the observer very likely saw a Trumpeter Swan, the details given failed to convince three members of the identification.

NORTHERN BOBWHITE *Colinus virginianus*. A report of two males and a female from Confidence, TUO, 15 Mar–11 Aug 1998 (1998-113) was not accepted because details on the identification were not conclusive, particularly with respect to neotropical bobwhites. Furthermore, those members who accepted the identification questioned the natural occurrence of these birds.

MONGOLIAN PLOVER *Charadrius mongolus*. A report of an apparent adult female seen at a distance of 100 to 200 yards by a single observer at Bolsa Chica, ORA, 17 Jul 1999 (1999-141) was thought to quite likely pertain to this species but gained little support. The description did not rule out a Greater Sandplover (*C. leschenaultii*), and some members were concerned that the bird might have been a stained or color-marked plover of another species.

AMERICAN OYSTERCATCHER *Haematopus palliatus*. A brief description of one at San Clemente I., LA, 4–5 Aug 1999 (2000-030) was not detailed enough to eliminate a hybrid with the Black Oystercatcher (*H. bachmani*). Photographs of this bird apparently exist but were never received by the Committee.

SPOTTED REDSHANK *Tringa erythropus*. "Six to nine" birds seen only in flight along the Santa Ana R., ORA, 16 Oct 1999 (1999-172) were thought by the

Committee probably to be misidentified Long-billed Dowitchers (*Limnodromus scolopaceus*).

RED-NECKED STINT *Calidris ruficollis*. A brief description of an adult at the Santa Clara R. Mouth, VEN, 25 Jun 1999 (1999-138) failed to convince the Committee that the bird seen was not a small Sanderling (*C. alba*).

LONG-TOED STINT *Calidris subminuta*. The description of an injured juvenile in a closed area of the Lower Klamath N. W. R., SIS, 13 Aug 1999 (2000-051) did not eliminate a bright Least Sandpiper (*C. minutilla*), as some key features, such as the pale base to the mandible, the loral pattern, and the toes, were not described.

WHITE-RUMPED SANDPIPER *Calidris fuscicollis*. A shorebird described from near Selma, FRE, 1 Sep 1999 (1999-199) was quite possibly this species, but the bird was observed without a scope, resulting in some important details being overlooked. Additionally, the white rump was not seen to confirm the identification.

CURLEW SANDPIPER *Calidris ferruginea*. A belated submission of one at Virgin Creek Beach, MEN, 4 Aug 1997 (2000-114) was not detailed enough to confirm the identification. The description of the bill as short, blunt tipped, and with a pale base seemed wrong for this species, suggesting perhaps a Red Knot (*C. canutus*) with a bill deformity. Rather brief descriptions of another at Bolinas Lagoon, MRN, 14–20 Sep 1999 (1999-154) failed to eliminate a Stilt Sandpiper (*C. himantopus*), present there at the same time.

LITTLE GULL *Larus minutus*. The description of a first-year bird migrating north with Black-legged Kittiwakes (*Rissa tridactyla*) past Pigeon Pt., SM, 21 May 1999 (1999-111) failed to eliminate the possibility that the bird may have been a Bonaparte's Gull (*L. philadelphia*).

ICELAND GULL *Larus glaucoides*. Four first-winter birds failed to gain Committee acceptance. Three of these were studied and photographed at the San Jose–Santa Clara Water Pollution Control Plant, SCL, 12 Feb–6 Mar 1999 (1999-074†), 26 Feb–5 Mar 1999 (1999-123†‡), and 8 Mar 1999 (1999-124†), and the fourth was seen and photographed at Doheny State Beach, ORA, 13 Feb–12 Mar 1999 (1999-072†‡). The Committee continues to maintain conservative standards about what constitutes an "Iceland Gull" in California. Although all four of these birds would likely be identified as this species in eastern North America, concerns about the range of variation in Thayer's Gulls (*L. thayeri*), particularly as a result of bleaching late in the winter, and the possibility of various hybrid gull combinations resulted in a maximum of two accept votes for any of these records. Rottenborn and Morlan (2000) outlined the criteria the Committee used in assessing these records. Terrill et al. (1999) discussed the three Santa Clara birds, including a photograph of the bird in record 1999-074.

SLATY-BACKED GULL *Larus schistisagus*. A first-winter gull perhaps of this species was at the Davis Oxidation Ponds, YOL, 4 Nov–12 Dec 1998 (1998-209†). It was slightly paler than the many Herring Gulls (*L. argentatus*) it associated with and had pale underwings like those of a Glaucous-winged Gull (*L. glaucescens*). Patterns of the individual primaries were consistent with those of known Slaty-backed Gulls (see Pyle 1997b), and most members agreed that this bird was a reasonable match to what they felt a first-winter bird of this species should look like. The Committee also agreed, however, that identification of first-winter Slaty-backed Gulls is still confounded by ignorance of diagnostic characteristics. In particular, most members felt that the possibility of this bird being a hybrid Glaucous-winged × Herring Gull, perhaps back-crossed to a Herring Gull, could not be ruled out, despite its differences from other gulls presumed to be of this hybrid combination. In the future, perhaps, improved knowledge of large-gull identification will permit reassessment of this and other records of the Slaty-backed Gull in California.

RUDDY GROUND-DOVE *Columbina talpacoti*. An incompletely described small dove at a feeder in Valley Center, SD, 24 Jun 1999 (1999-169) was noted as lacking scaling on the head and neck but had a fairly pronounced whitish eye ring and iridescent flecks on the neck, suggesting a different species. Although some of the multiple wintering birds at Furnace Creek Ranch, INY, have remained into June and July, there are no other June records of this species in California. Another dove at Galileo Hill Park, KER, 21 Oct 1999 (2000-031) was likely this species but was not studied critically enough to confirm the identification.

RUBY-THROATED HUMMINGBIRD *Archilochus colubris*. A hummingbird with a golden-green back in Big Sycamore Canyon, VEN, 1–6 Oct 1999 (1999-160), initially thought to be perhaps an immature male Ruby-throated, was later identified as an Anna's (*Calypte anna*).

THREE-TOED WOODPECKER *Picoides tridactylus*. When this record from the South Warner Wilderness, MOD, 2 Nov 1985 originally circulated 15 years ago, several members anticipated further observations of this species, inferring that there was probably a resident population in the area. This has proven not to be the case, and the record was recirculated (1985-146A) for reassessment with this knowledge. Ultimately, after four rounds of circulation and discussion at the 2001 annual meeting, only two members continued to support the identification; the Three-toed Woodpecker has thus been removed from the state list. For details of this record, see Bevier (1990) and Trochet et al. (1988). The Committee's stance on single-observer first-state records that lack physical documentation has become more conservative over time, and there are no longer any species on the California list based solely on such records.

EASTERN WOOD-PEWEE *Contopus virens*. The plumage description of a bird near Pt. Sur, MTY, 21–25 Sep 1999 (1999-179§) seemed good for this species, as did some of the described vocalizations, but tape-recorded vocalizations suggested that the bird actually may have been a Western Wood-Pewee (*C. sordidulus*). In particular, the taped clear "pwee" notes are monotone and often slightly burry, rather than clear and sharply upslurred. Another record of a silent immature studied at close range for two hours and photographed on Southeast Farallon I., SF, 5 Sep 1998 (1999-009†) received considerable support, with only two members expressing reservations about the identification. In direct comparison with several nearby Western Wood-Pewees this bird had a grayer head contrasting with a greener back, blacker wings with conspicuously brighter whitish (tinged lemon) wing edgings, whiter and more contrasting throat, and much more extensive, brighter orange on the lower mandible. Perhaps of greatest significance, the distance between the distal end of the uppertail coverts and the tail tip was much greater on this bird than on the Western Wood-Pewees, perhaps in the range diagnostic of the Eastern Wood-Pewee (see Pyle 1997c).

YELLOW-BELLIED FLYCATCHER *Empidonax flaviventris*. An intriguing description of a silent *Empidonax* studied carefully for two hours at Galileo Hill Park, KER, 26 Sep 1999 (2000-043) included many field marks of this species, but the back color, described as "deep olive with some slight grayish tones" and "uniformly brownish-olive" by the two observers, was atypical. Ultimately a majority of the Committee felt it best to leave this individual unidentified.

DUSKY-CAPPED FLYCATCHER *Myiarchus tuberculifer*. A silent *Myiarchus* at Oceano, SLO, 21 Nov 1999 (2000-032) was likely this species, given the date and location, but the very brief description was insufficient to substantiate the identification.

BLUE-HEADED VIREO *Vireo solitarius*. The single description received of a widely seen bird at the Pt. Reyes lighthouse, MRN, 19 Sep 1999 (1999-157) could

have pertained to a bright Cassin's Vireo (*V. cassinii*).

YELLOW-GREEN VIREO *Vireo flavoviridis*. An unprecedented spring report of a bird seen for ten seconds, mostly without binoculars, at Big Morongo Reserve, SBE, 11 May 1999 (1999-120) failed to receive any support. A bird on eastern Santa Cruz I., SBA, 17 Sep 1999 (1999-158), apparently identified by others as a Red-eyed Vireo (*V. olivaceus*), and another at Fort Rosecrans National Cemetery, SD, 11 Oct 1999 (1999-171†), reported to have completely yellow underparts, received only minority support after two circulations.

CAVE SWALLOW *Petrochelidon fulva*. An interesting swallow observed and sketched at the North Prado Basin, SBE, 29 Apr 1999 (1999-090) had some features suggesting a Cave Swallow, but the color of the back, forehead, and rump, and especially the lack of a capped appearance (the blue crown being connected to the blue back) strongly suggested that the bird was actually a hybrid Barn (*Hirundo rustica*) × Cliff (*P. pyrrhonota*) swallow (Pyle 1997a). One such hybrid was photographed at Mystic L., RIV, 15 May 1999 (Michael A. Patten pers. comm.), and others have been seen N of California City, KER, 7 Oct 1997, near Pt. Mugu, VEN, 2 Sep 1999, and at Finney L., IMP, 10 Sep 2000 (Jon L. Dunn pers. comm.).

EASTERN BLUEBIRD *Sialia sialis*. The report of a male and "possible" female observed for "two minutes" on private property at Benton Hot Springs, MNO, 4 Jun 1999 (1999-129) by an excellent observer was intriguing, as the male was fairly well described. However, single-observer first state records lacking physical evidence are held to very high standards, and the record received little support, as anticipated by the observer. Some members expressed concern about hybrid Mountain Bluebirds (*S. currucoides*) (e.g., Lane 1968, Spear 1975), a possibility that was not considered by the observer. Neither bird could be relocated on later visits. The observer noted that any bluebird at this location on this date would be unusual, with the Western Bluebird (*S. mexicana*) being a rare and irregular visitor to Mono Co. and the Mountain Bluebird being expected only at higher elevations. Dunn (1981) prepared a useful summary of bluebird distribution and identification.

SPRAGUE'S PIPIT *Anthus spragueii*. Incomplete or brief descriptions of single birds at widely spaced locations, both on 5 Dec 1999, by the same observer left little doubt that they were misidentifications of a more common species, perhaps a pale Savannah Sparrow (e.g., *Passerculus sandwichensis nevadensis*), which has whitish outer edges to the tail. The first was reported from L. Perris Dam, RIV (1999-201), the second from Long Beach, LA (1999-202).

WORM-EATING WARBLER *Helmitheros vermivorus*. A briefly seen bird at Butterbredt Springs, KER, 20 Apr 1999 (1999-089) received only two votes to accept on its second circulation. Although the description suggested a Worm-eating Warbler, it was not sufficient to extend the earliest spring record for this species in California by ten days.

MOURNING WARBLER *Oporornis philadelphia*. A briefly described bird at the Iron Mt. Pumping Plant, SBE, 16 Oct 1998 (1998-224) failed to gain acceptance after three rounds of circulation.

SCARLET TANAGER *Piranga olivacea*. A description from Saline Valley, INY, 17 Nov 1999 (2000-008) did not eliminate the possibility of a Summer Tanager (*P. rubra*).

SNOW BUNTING *Plectrophenax nivalis*. A calling bird seen flying overhead briefly and without binoculars by an experienced observer at Venice Beach in Half Moon Bay, SM, 28 Nov 1997 (2000-042) was likely correctly identified but did not meet the Committee's minimum standard for acceptance, particularly since the similar McKay's Bunting (*P. hyperboreus*) could not be eliminated under such conditions.

PAINTED BUNTING *Passerina ciris*. A very brief description of a bird at Furnace Creek Ranch, INY, 16 Oct 1999 (1999-173) was insufficient to confirm the identification. It is possible that this bird may have been the same as that in accepted record 1999-175B, discussed above.

COMMON GRACKLE *Quiscalus quiscula*. What was thought initially to be perhaps California's first Purple Grackle (*Q. q. stonei/quiscula*) summered at Preisker Park in Santa Maria, SBA, 8 May–5 Jul 1999 (1999-122†). The bird also foraged across the Santa Maria R. in nearby San Luis Obispo Co. It assisted a pair of Brewer's Blackbirds (*Euphagus cyanocephalus*) in raising their young, bringing food to the nest in late May (often being chased by the blackbirds when doing so) and feeding fledglings in late June. Although this bird's size and shape resembled those of a Common Grackle, the bird's courtship displays (given only to Brewer's Blackbirds) and tail cocking recalled the Great-tailed Grackle (*Q. mexicanus*), whereas the vocalizations were similar to those of a Brewer's Blackbird. Additionally, several plumage features on this bird were not typical of any race of Common Grackle. In particular, it did not have the typical strongly contrasting hood of a Common Grackle, usually bluish in *versicolor* and *stonei* and purple in *quiscula*. The uniform purple back of the Santa Maria bird was inconsistent with that of a Common Grackle, which should be bronze (*versicolor*), green (*quiscula*), or purple with variegated and barred patterning (*stonei*). The uniformly purple wing coverts were also atypical of Purple Grackles, which generally have blue coverts. A hybrid Brewer's Blackbird × Great-tailed Grackle could explain the behavioral and plumage features of this bird, and most Committee members felt that this was indeed the individual's identity.

COMMON REDPOLL *Carduelis flammea*. Although the identification of this male Common Redpoll specimen, taken by an unnamed person from an unspecified location in "Plumas County," 23 Dec 1899 (#SDNHM 27420; 1992-051), was not disputed, there was considerable controversy regarding the location at which the specimen was obtained and whether a specimen without a collector's name and precise location constitutes an acceptable record. Even if the county designation on the specimen tag was correct (and lacking a precise location this may be questionable), the boundary between Plumas and Lassen counties has changed since 1895, raising the possibility that the bird may have been taken in what is now Lassen County. The method of specimen preparation suggests that this bird may be one of a series collected by J. M. Willard from a flock at Eagle L. in Lassen County during his stay from 30 November to 23 December 1899, particularly since all of the five specimens from that flock were taken on the same date as this bird. This individual was likely part of the major redpoll invasion into northeast California in 1899 but may well have been part of the Eagle L. flock and therefore not a new record separate from CBRC record 1984-159.

RECORDS NOT ACCEPTED, NATURAL OCCURRENCE QUESTIONABLE (IDENTIFICATION ACCEPTED)

HARRIS'S HAWK *Parabuteo unicinctus*. One was observed from Highway 101 south of Nacimiento Creek, MTY, 20 Nov 1998 (SES, LSp; 1999-192). The Committee was not ready to accept a report from northern California, given that a background level of escapees is known to occur in the state and that invasions of this species typically extend into the southern deserts only (Patten and Erickson 2000).

GRAY SILKY-FLYCATCHER *Ptilogonys cinereus*. A heavily worn bird with a damaged tail at Cabrillo National Monument, Pt. Loma, SD, 16 Jun 1999 (REW; 1999-121) was thought by the observer to be likely an escaped caged bird, a conclusion shared by the Committee. The Committee received no details supporting

reports of this individual on 28 Jul and 18 Aug 1999 (*N. Am. Birds* 54:106). Previous records of this species from coastal urban locations near the Mexican border have also been deemed to be of questionable natural occurrence.

Another long-staying, well-documented male at a more remote location near Blue Jay Campground in the Cleveland National Forest, Santa Ana Mts., ORA, 29 Jan–19 Feb 1999 (DLo†‡; RAH, ChH, KZK†, LML‡, MJM, CAM, GMcC, DWM, JMo, BP, CER, DR†, MMR†, LSa†, JWb†, MW, JOZ; 1999-051) was felt by many observers to be a naturally occurring vagrant. In each of two rounds of circulation, seven members felt that the natural occurrence of this individual was questionable. Although this bird showed no signs of cage wear, it is impossible to know whether cage worn feathers had been replaced by molt. The location, although admittedly more remote than those of previous records in urban areas, could easily be reached by an escaped cage bird; in fact, Black-throated Magpie-Jays (*Calocitta colliei*) are known not far from this spot. Despite claims to the contrary, this species is kept as a cagebird adjacent to the California border in Mexico (R. A. Hamilton in litt.). Although the Gray Silky-flycatcher is not known to wander widely, most members felt that such movement could be possible. There is a record from northwestern Baja California (Cota-Campbell and Ruiz-Campos 1995), but it too may be of questionable origin. In the end, the lack of records from Arizona, which is much closer to the normal range of this species, and the limited (two) records from Texas, within 100 miles of known populations, make all five California records suspect, particularly because several of these birds have shown signs of prior captivity. Currently, a majority of the Committee is unlikely to accept this species to the state list until records from Arizona and intervening areas in Mexico are documented. However, in realization that some of the California records may indeed pertain to naturally occurring vagrants, the species was added to the Supplemental List (Erickson and Hamilton 2001). A color photograph of this bird was published on the cover of *N. Am. Birds* 53 (2).

PAINTED BUNTING *Passerina ciris*. An adult male and female feeding with six Nutmeg Mannikins (*Lonchura punctulata*) and two White-collared Seedeaters (*Sporophila torqueola*) at the Dairy Mart Pond, Tijuana R. valley, SD, 30 Dec 1999–8 Jan 2000 (GMcC; 2000-047) were close to the Mexican border at a time of year when naturally occurring vagrants are not expected. All but two members felt the origin of these birds was questionable. An adult male visiting a water drip at a desert oasis with many other migrants at Corn Spring, RIV, 19 Apr 1997 (JF†; 1997-090) ultimately failed to gain acceptance, with four members of the Committee considering the natural occurrence of the bird questionable. The concern was that spring migrants in California may be birds formerly held in captivity to the south, especially in this case, given the relatively early date in comparison to the late May dates of previously accepted spring adult males.

CONTRIBUTORS

Steve Abbott (SAb), Brian C. Acord, Scot Anderson (SAn), Zona Appleby, John Ayres, Stephen F. Bailey (SFB), Corinne Bandell, Bruce Barrett, Alan D. Barron, Ron Beck (RBe), Shauna Bingham (SBi), Jim Booker (JBo), William G. Bousman, Jean Brandt (JBr), Ronald L. Branson (RLB), Karen Bridgers (KBr), Ryan D. Burnett (RDB), Kenneth Burton (KBu), Phil Capitolo, Kris K. Carter, George Chaniot, Jamie Chavez, Les Chibana (LCh), Ryan Chornock, Herb Clarke, Luke Cole (LCo), Dave Compton, Chris Corben, Brian E. Daniels (BED), Jim Danzenbaker (JDa), Jeff Davis (JDs), Stephen J. Davis, Maya Decker, Al DeMartini, Bill Deppe (BDe), Don DesJardin, Vladimir Dinets, Jon L. Dunn (JLD), Todd Easterla, Alan M. Eisner, Ray Ekstrom (REk), Steven R. Emmons, Richard A. Erickson (RAE), Gil Ewing, Matt Farley (MFa), Robbie Fischer, David Fix, Moe Flannery (MFl), Chris Floyd, Lillian Fujii, Ian Gaffney, Roger Garcia, Kimball L. Garrett (KLG), Karen S. Gilbert (KSG), Steve Glover, Ed

Greaves, Jim Greaves (JGs), John F. Green (JFG), Daniel A. Guthrie, Robert A. Hamilton (RAH), Steve Hampton (SHa), Bob Hansen (BHa), Jan J. Hansen (JJH), Joan Hardie (JHd), Sanger Hedrick (SHe), Jo Heindel (JoH), Matt T. Heindel (MTH), Mitch Heindel (MiH), Tom Heindel, Bill Hill (BiH), Brad Hines (BrH), Craig Hohenberger (CrH), Dylan Holstein-Rodin, Charles Hood (ChH), Marcel Holyoak (MHo), Andrew Howe, Vernon Howe, Steve N. G. Howell (SNGH), Robert A. Hudson (RHu), Richard K. Irvin, Alvaro Jaramillo, Curtis O. Johnson, Robert J. Keiffer, Paul Keller, Clay Kempf, David Kisner (DKi), Daniel Koenig (DKo), Kenneth Z. Kurland (KZK), Keith Kwan (KKw), Ed Kwater, Dan Lane (DLa), Joan E. Lentz, Nick Lethaby, Ron LeValley (RLeV), Cindy Lieurance, Leslie M. Lieurance, Roger Linfield (RLd), Daniel Lockshaw (DLo), Gene Lynch, David Magney (DMa), Michael J. Mammoser, Curtis A. Marantz, John Mariani (JMi), John Martin (JMt), Robert E. Maurer, Jr., Guy McCaskie, Todd McGrath (TMcG), Tristan McKee (TMcK), Patrick McNulty (PMcN), Peter J. Metropulos (PJM), Dale W. Mitchell (DWM), Barbara Monahan (BaM), William J. Moramarco, Joseph Morlan (JMo), Brennan Mulrooney (BMu), Dan W. Nelson (DWN), David Nelson (DvN), Kristie N. Nelson, Vince Orsini, Debby Parker (DPa), Jim Parker (JPa), Michael A. Patten (MAP), Gary Peebles (GPe), Dharm Pellegrini (DPe), J. D. Phillips (JDP), James E. Pike (JEP), Tim Plunkett, Jeff Poklen (JPn), Molly Pollock (MPo), Gary W. Potter (GWP), David J. Powell (DJP), Jude Claire Power (JCP), Bill Principe, Peter Pyle,, David E. Quady, George Redpath (GRe), Bill Reese (BRe), Peter Relson, Barbara Ribble (BRi), Adam C. Rich, Will Richardson, Christine E. Rideout, Michael F. Robbins (MFR), Don Roberson, Geoff Rogers (GRo), Michael M. Rogers (MMR), Stephen C. Rottenborn (SCR), Steve Rovell (SRv), Ronnie Ryno, Ronald M. Saldino (RMS), Ivan Samuels, Mike San Miguel (MSM), Michael J. San Miguel, Jr. (MJSM), James R. Sams (JRS), Larry Sansone (LSa), Jack W. Schlotte, Brad Schram, Jeff Seay (JSy), Douglas G. Shaw (DGS), Debra L. Shearwater (DLSh), Dave Shuford (DSd), Jim Smith (JSm), Reed V. Smith (RVS), Susan E. Smith (SES), John Sorensen (JSo), Steve Sosensky (SSo), Larry Spear (LSp), Rich Stallcup (RiS), Daniel Stoebel (DSt), Mary Beth Stowe (MBS), Kirk Swenson, Richard Ternullo (RTe), Scott B. Terrill (SBT), Ronald S. Thorn (RST), John S. Tiffany (JST), Guy Tingos, John Trochet (JTr), Dave Trochlell, Steve Tucker (STu), Philip Unitt, Sophie Webb, Richard E. Webster, Joel Weintraub (JWb), Jerry Wettle (JWt), Jerry White (JWh), Michael Wienholt, Bob Wilkerson, Douglas R. Willick, Angus Wilson, Irwin Woldman, Joseph Worley (JWo), Thomas E. Wurster, David G. Yee, James O. Zimmer.

ACKNOWLEDGMENTS

This report would not have been possible without the 194 observers who submitted reports to the Committee. Many others also assisted the Committee in gathering information and offering informed analysis of several records. Hiroshi Hasagawa shared his expertise on age determination in the Short-tailed Albatross, and Tony Palliser offered expert advice on the Great-winged Petrel record. David Ainley and Larry Spear provided input on the Wedge-rumped Storm-Petrel. Walter Wehtje provided documentation for the Black-bellied Whistling-Duck, while Tamar Danufsky provided the specimen number of the Yellow Rail. Bruce Mactavish expressed his opinion on "Iceland Gull" 1999-074, and Martin Reid provided comments on molt timing in Lesser Black-backed Gulls. Janet Hinshaw submitted details and photographs of Long-billed Murrelet record 2000-067. Joan Lentz helped sort out the reports of the Santa Barbara County Dusky-capped Flycatcher. Comments on the origin of the Orange County Gray Silky-flycatcher were received from Greg Lasley and Kurt Radamaker, in addition to many of the observers cited above. Robert McKernan provided documentation for the Red-faced Warbler. Louis Bevier commented on the Santa Maria "Purple Grackle." Drafts of this report were reviewed and

improved by Robert A. Hamilton, Richard A. Erickson, Guy McCaskie, Michael A. Patten, Jon L. Dunn, Peter Pyle, Tristan McKee, and John C. Wilson. Peg Stevens and Jon C. Fisher continued to archive the committee's materials at WFVZ. We extend our thanks to all.

LITERATURE CITED

American Ornithologists' Union. 1998. Check-list of North American Birds, 7th ed. Am. Ornithol. Union, Washington, D. C.

Bevier, L. R. 1990. Eleventh report of the California Bird Records Committee. W. Birds 21:145–176.

Birch, A., and Lee, C. T. 1997. Arctic and Pacific loons: Field identification. Birding 29:106–115.

Birdlife International. 2000. Threatened Birds of the World. Lynx Edicions, Barcelona.

Clapp, R. B., Klimkiewicz, M. K., and Kennard, J. H. 1982. Longevity records of North American birds: Gaviidae through Alcidae. J. Field Ornithol. 53:81–124.

Cole, L. W. 2000. A first Shy Albatross, *Thalassarche cauta*, in California and a critical re-examination of Northern Hemisphere records of the former *Diomedea cauta* complex. N. Am. Birds 54:124–135.

Cota-Campbell, F., and Ruiz-Campos, G. 1995. First record of the Gray Silky-Flycatcher from Baja California, Mexico. W. Birds 26:197–199.

Dunn, J. L. 1981. The identification of female bluebirds. Birding 13:4–11.

Dunn, J. L. 1988. Tenth report of the California Bird Records Committee. W. Birds 19:129–163.

Erickson, R. A., and Hamilton, R. A. 2001. Report of the California Bird Records Committee: 1998 records. W. Birds 32:13–49.

Froke, J. B. 1981. Populations, movements, foraging and nesting of feral *Amazona* parrots in southern California. M. S. thesis. Humboldt State University, Arcata, CA.

Garrett, K. L. 1997. Population status and distribution of naturalized parrots in southern California. W. Birds 28:181–195.

Garrett, K. L., and Singer, D. S. 1998. Report of the California Bird Records Committee: 1995 records. W. Birds 29:133–156.

Garrett, K. L., Mabb, K. T., Collins, C. T., and Kares, L. M. 1997. Food items of naturalized parrots in southern California. W. Birds 28:196–201.

Grant, P. J. 1986. Gulls: A Guide to Identification. Buteo Books, Vermillion, SD.

Grinnell, J., and Miller, A. H. 1944. The distribution of the birds of California. Pac. Coast Avifauna 27.

Haynie, C. B. 1996. Texas Bird Records Committee Report for 1995. Bull. Tex. Ornithol. Soc. 29:2–10.

Heindel, M. T. 1996. Field identification of the Solitary Vireo complex. Birding 28:458–471.

Heindel, M., and Pyle, P. 1999. Identification of Yellow-bellied and "Western" Flycatchers. Birders' J. 8:78–87.

Howell, S. N. G., and Pyle, P. 1997. Twentieth report of the California Bird Records Committee: 1994 records. W. Birds 28:117–141.

Howell, S. N. G., and Webb, S. 1995. A Guide to the Birds of Mexico and Northern

Central America. Oxford Univ. Press, Oxford, England.

Jehl, D. R., and Jehl, J. R., Jr. 1981. A North American record of the Asiatic Marbled Murrelet (*Brachyramphus marmoratus perdix*). Am. Birds 35:911–912.

Jonsson, L. 1998. Baltic Lesser Black-backed Gull *Larus fuscus fuscus*—moult, ageing and identification. Birding World 11:295–317.

Kennerley, P. R., Hoogendoorn, W. (T.), and Chalmers, M. L. 1995. Identification and systematics of large white-headed gulls in Hong Kong. Hong Kong Bird Rep. 1994, pp. 127–156.

Lane, J. 1968. A hybrid Eastern Bluebird × Mountain Bluebird. Auk 85:684.

Langham, J. M. 1991. Twelfth report of the California Bird Records Committee. W. Birds 22:97–130.

Lethaby, N. 2000. The identification of Long-billed Murrelet in alternate plumage. Birding 32:438–444.

Luther, J. S., McCaskie, G., and Dunn, J. 1983. Fifth report of the California Bird Records Committee. W. Birds 14:1–16.

Mabb, K. T. 1997a. Roosting behavior of naturalized parrots in the San Gabriel Valley, California. W. Birds 28:202–208.

Mabb, K. T. 1997b. Nesting behavior of *Amazona* parrots and Rose-ringed Parakeets in the San Gabriel Valley, California. W. Birds 28:209–217.

McCaskie, G., and San Miguel, M. 1999. Report of the California Bird Records Committee: 1996 records. W. Birds 30:57–85.

Mlodinow, S. G. 1997. The Long-billed Murrelet (*Brachyramphus perdix*) in North America. Birding 29:460–475.

Naveen, R. 1982. Storm-petrels of the world, an introductory guide to their identification, part III. Birding 14:56–62.

Ouellet, H. 1993. Bicknell's Thrush: Taxonomic status and distribution. Wilson Bull. 105:545–572.

Patten, M. A., and Erickson, R. A. 1994. Fifteenth report of the California Bird Records Committee 25:1–34.

Patten, M. A., and Erickson, R. A. 2000. Population fluctuations of the Harris' Hawk (*Parabuteo unicinctus*) and its reappearance in California. J. Raptor Res. 34:187–195.

Pitman, R. L., and Jehl, J. R., Jr. 1998. Geographic variation and reassessment of species limits in the "Masked" Boobies of the eastern Pacific Ocean. Wilson Bull. 110:155–166.

Pyle, P. 1997a. Identification Guide to North American Birds. Slate Creek Press, Bolinas, CA.

Pyle, P. 1997b. First year Slaty-backed Gull. Birders' J. 6:251.

Pyle, P. 1997c. A further examination of wing and tail formulae in *Empidonax* and *Contopus* flycatchers, in The Era of Allan R. Phillips: A Festschrift (R. W. Dickerman, compiler), pp. 147–154. Horizon Communications, Albuquerque.

Pyle, P., and McCaskie, G. 1992. Thirteenth report of the California Bird Records Committee. W. Birds 23:97–132.

Rauste, V. 1999. Kennzeichen und Mauser von "Baltische Heringsmöwen" *Larus (fuscus) fuscus* und "Tundramöwen" *Larus (fuscus) heuglini*. Teil I & II. Limicola 13:105–128; 153–188.

Roberson, D. 1986. Ninth report of the California Bird Records Committee. W. Birds 17:49–77.

Roberson, D. 1993. Fourteenth report of the California Bird Records Committee. W. Birds 24:113–166.

Roberson, D. 1998. Sulids unmasked: Which large booby reaches California? Field Notes 52:276–287.

Robertson, C. J. R., and Nunn, G. B. 1998. Towards a new taxonomy for albatrosses, in Albatross Biology and Conservation (G. Robertson and R. Gales, eds.), pp. 13–19. Surrey Beatty, Chipping Norton, Australia.

Rottenborn, S. C., and Morlan, J. 2000. Report of the California Bird Records Committee: 1997 records. W. Birds 31:1–37.

Sealy, S. G., Carter, H. R., Shuford, W. D., Powers, K. D., and Chase, C. A., III. 1991. Long-distance vagrancy of the Asiatic Marbled Murrelet in North America. W. Birds 22:145–156.

Smith, M. R. 1999. First Sooty Tern nest in the contiguous western United States. W. Birds 30:121–122.

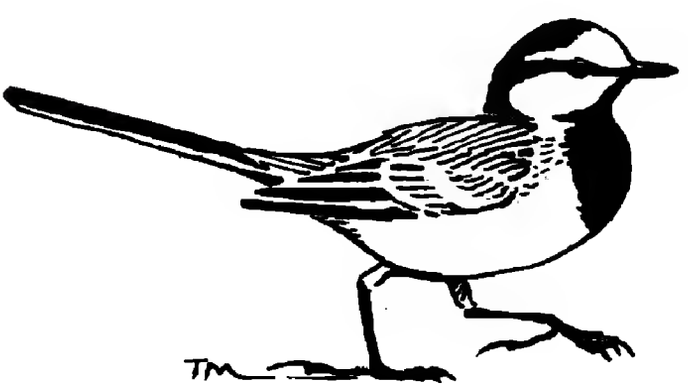
Spear. J. 1975. Hybrid bluebird nesting near Russell, Manitoba. Blue Jay 33:321.

Stallcup, R. 1990. Ocean Birds of the Nearshore Pacific. Pt. Reyes Bird Obs., Stinson Beach, CA.

Terrill, S. B., Rottenborn, S. C., Singer, D. S., and Roberson, D. 1999. Winter season: Middle Pacific coast region. N. Am. Birds 53:203–207.

Trochet, J., Morlan, J., and Roberson, D. 1988. First record of the Three-toed Woodpecker in California. W. Birds 19:109–115.

Accepted 6 November 2001



AUTUMN POPULATIONS OF BIRDS IN RIPARIAN HABITAT OF CALIFORNIA'S CENTRAL VALLEY

DIANA L. HUMPLE and GEOFFREY R. GEUPEL, Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach, California 94970

ABSTRACT: Using mist netting and area-search censuses, we monitored fall landbird migration in remnant riparian habitat along the Sacramento, San Joaquin, and Cosumnes rivers from 1995 to 1999. We detected 125 species, 73 of which we captured in mist nets. Six species of passerines were captured in mist nets but not detected on area searches; 22 passerines were detected on area searches but not captured in mist nets. Age ratios in each region ranged from two to four young for every adult captured. In the Central Valley the ratio of young to adults is lower for most species than along the coast of central California, implying that the valley is more important as a migration route than the coast. At 74.6 birds per 100 net hours capture rates were approximately twice as high along the Cosumnes River than in the other two regions, the Sacramento and San Joaquin rivers. The capture rate of neotropical migrants was highest along the Sacramento River, where 18 species were caught. Capture rates along the Cosumnes River were highest for resident species and along the San Joaquin River for wintering species. The use of these remnant riparian sites by numerous species, many of current conservation interest in California, suggests the importance of this habitat to landbirds in the West during the autumn.

The Central Valley of California lies between the Sierra Nevada to the east and the Coast Range to the west. The valley's two major rivers, the Sacramento and the San Joaquin, running along the valley floor and emptying into the delta and eventually the San Francisco Bay, historically contained one of the largest systems of riparian woodland in the West. Development, agriculture, grazing, water diversion, and channelization have drastically reduced the riparian habitat along these rivers and their tributaries to approximately 5% of its historic extent (Katibah 1984). The importance of the Central Valley's remaining riparian habitat to breeding landbirds has been well established (Miller 1951, Gaines 1977, RHJV 2000). Data on habitat use in general by migrating landbirds, however, are scarce (Petit 2000), and systematic surveys in Central Valley riparian habitat are virtually nonexistent (Cogswell 1962).

To determine autumn use of this remnant habitat by migrant and resident landbirds, the Point Reyes Bird Observatory (PRBO) conducted constant-effort mist netting and area searches at sites along the Sacramento, San Joaquin, and Cosumnes rivers from August through October, 1995 through 1999. While mist nets sample primarily smaller landbirds, area searches sample all bird species. We determined capture rates and age ratios for each species in the three regions and compared results derived from mist nets and area searches. For selected migrants we also present capture rates throughout the season and rates of recaptures in successive years.

STUDY AREA AND METHODS

We monitored eight sites, three along the San Joaquin River, two along the Cosumnes, and three along the Sacramento (Figure 1). Individual sites

Figure 1. Location of Central Valley study sites.

were run for two to five consecutive autumns (Table 1). All sites were located in remnant riparian habitat surrounded by agriculture, isolated from other native habitats.

Our three sites along the Sacramento River were in the Sacramento River National Wildlife Refuge, in Glenn and Tehama counties, on land cooperatively managed by the U.S. Fish and Wildlife Service and the Nature Conservancy. The tree community at these sites is dominated by Goodding's Black Willow (*Salix gooddingii*), Sandbar Willow (*Salix sessilifolia*), Fremont Cottonwood (*Populus fremontii*), and Valley Oak (*Quercus lobata*). The shrub layer consists primarily of Sandbar Willow, Blue Elderberry (*Sambucus mexicana*), California Blackberry (*Rubus ursinus*), and nonnative Himalayan Blackberry (*Rubus discolor*). The surrounding landscape is predominantly orchard.

Our two sites along the Cosumnes River were in the Cosumnes River Preserve near Galt, Sacramento County, on land managed primarily by the Nature Conservancy. The vegetation here is similar to that at the Sacra-

Table 1 Summary Statistics for Fall Migration Banding in Three Regions of the Central Valley

	Sacramento River NWR	Cosumnes Preserve	San Luis NWR
Years of mist-netting and area searches	Ohm: 95–99 Phelan Island: 95–99 Sul Norte: 95, 99	Tall Forest: 95–97 Wendell's Levee: 96–97	North SL: 95–97 South SL: 95–97 Oxbow: ½ 96, 97
Total number of net hours (nh)	5712	2379	3640
Total number of area-search censuses[a]	361	117	192
Overall capture rate (per 100 nh)	39.6	74.6	32.0
Mean annual capture rate per 100 nh (SD)	42.8 (16.9)	72.0 (32.4)	32.2 (7.4)
Species richness (mist-netting only)	55	49	51
Species richness (area searches only)	109	76	89
Species richness (mist-nets and area searches)	112	81	96
Age ratio (young/adult)	2.23:1	3.90:1	2.06:1
Percent of individuals aged	74%	88%	80%
Capture rate of neotropical migrants (per 100 nh)	15.4	10.9	3.5
Capture rate of residents (per 100 nh)	9.9	37.9	11.9
Capture rate of wintering species (per 100 nh)	13.8	23.0	15.1

[a]Each survey of one plot equals one census.

mento River sites but with less Blue Elderberry in the shrub layer. One site was located adjacent to a large remnant woodland of Valley Oak, the other along a levee lacking Valley Oaks. Surrounding agriculture includes row crops, rice, alfalfa fields, and grazed pastures.

The three sites along the San Joaquin River were in the San Luis National Wildlife Refuge, Merced County, north of Los Banos. Goodding's Black Willow, Sandbar Willow, and Himalayan Blackberry dominate the tree and shrub layers at these sites. The surrounding agricultural landscape includes cotton and alfalfa fields.

We ran 10 nets (30-mm mesh, 12 m long) once a week at each site between 18 August and 31 October, for approximately 10 visits to each site each year. The exception was one site at San Luis, established mid-season in 1996 and monitored on only seven visits that autumn. Net locations remained constant throughout the study. Nets were opened 15 minutes after sunrise, remained open for 5 hours, and were opened and closed in the

same order. Thus, when conditions permitted, each day represented 50 net hours of banding. Birds captured in the mist nets were banded, aged, sexed, measured, and weighed. Age was determined by skull pneumatization, plumage, and other appropriate characteristics (Pyle et al. 1987). Birds determined to be hatched in the year of capture were aged as young; those hatched earlier were classified as adults. Some individuals could not be aged reliably and were classified as unknown.

In addition to mist netting, we designated three census plots for area searches at each site within the riparian habitat around the nets. Plots covered approximately 3 hectares, sampled the same general area as the nets, and were restricted to the riparian habitat. Each plot was censused approximately once a week during the first few hours after sunrise, generally the same morning as mist netting. On some mornings when capture rates in the nets were high, biologists were unable to conduct area searches; occasionally they were done the following day. During an area search the observer covered the entire plot in 20 minutes, recording all birds using the habitat within the plot; see Ralph et al. (1993) and Slater (1994) for more details of this method.

For all species we determined the number of individuals captured per 100 net hours within each region and calculated the age ratio of birds captured (young/adult) and the percentage of birds that could be classified by age. We discuss age ratios only for species of which we caught $\geq$20 individuals and aged $\geq$80% of them. We assume no bias in favor of either age group being caught. We excluded from these analyses individuals released without bands, including species for which we did not have bands (e.g., larger birds and hummingbirds) and birds accidentally released before banding. For migrant species of sufficient sample size ($\geq$20 captures in each of two or more regions) we calculated the number of captures per 100 net hours by week, all years combined, except the final "week" extended from 20 to 30 October. In all these analyses we used only the first capture of an individual each year. For those species that do not breed in the Central Valley but use the region for migration or wintering, we determined the percentage of individuals captured in more than one year. We also present the species detected during area searches in each region.

RESULTS

At all sites combined, we captured a total of 73 landbird species (26 or 20.4% of them neotropical migrants) during the autumns of 1995 to 1999. Including the results of the area searches brings this total to 125 species (37 neotropical migrants). We captured 14 species (35.6% of all captures) that winter in the Central Valley but breed elsewhere and 29 year-round residents (40.7% of all captures).

At the Sacramento River National Wildlife Refuge, we netted 2264 birds (39.6 birds per 100 net hours) (Table 1). One hundred twelve species were detected with mist nets or area searches (see Tables 2 and 3 for species lists and capture data). The most frequently captured species were the Yellow Warbler and Ruby-crowned Kinglet. We caught more neotropical migrants than residents or winter visitors (see Table 2 for assignment of species to

Table 2 Numbers of Birds Banded and Area-Search Detections at Three Central Valley Riparian Sites[a]

Species	Status[b]	Sacramento River NWR	Cosumnes Preserve	San Luis NWR
Pied-billed Grebe (*Podilymbus podiceps*)	P	–		
Double-crested Cormorant (*Phalacrocorax auritus*)	P	–		–
Black-crowned Night-heron (*Nycticorax nycticorax*)	P			–
Snowy Egret (*Egretta thula*)	P	–		–
Great Egret (*Casmerodius albus*)	P	–		–
Great Blue Heron (*Ardea herodias*)	P	–	–	–
Wood Duck (*Aix sponsa*)	P	–	–	
Mallard (*Anas platyrhynchos*)	P		–	–
Turkey Vulture (*Cathartes aura*)	P	–	–	
Osprey (*Pandion haliaetus*)	P	–		–
White-tailed Kite (*Elanus leucurus*)	P	–		–
Northern Harrier (*Circus cyaneus*)	P	–		–
Sharp-shinned Hawk (*Accipiter striatus*)	W	3	1	2
Cooper's Hawk (*A. cooperii*)	P	–		–
Red-shouldered Hawk (*Buteo lineatus*)	P	–	–	
Red-tailed Hawk (*B. jamaicensis*)	P	–	*	–
Swainson's Hawk (*B. swainsoni*)	B[c]	–	–	
American Kestrel (*Falco sparverius*)	P	–	–	–
Merlin (*F. columbarius*)	W	–		
Ring-necked Pheasant (*Phasianus colchicus*)	P	–	–	–
Wild Turkey (*Meleagris gallopavo*)	P	–		
California Quail (*Callipepla californica*)	P	*	–	–
Sora (*Porzana carolina*)	P			–
Common Moorhen (*Gallinula chloropus*)	P			–
American Coot (*Fulica americana*)	P			–
Sandhill Crane (*Grus canadensis*)	W	–	–	
Killdeer (*Charadrius vociferus*)	P	–	–	–
Greater Yellowlegs (*Tringa melanoleuca*)	W	–		
Common Snipe (*Gallinago gallinago*)	W	–		
Mourning Dove (*Zenaida macroura*)	P	–	–	*
Yellow-billed Cuckoo (*Coccyzus americanus*)	B[d]	–		
Barn Owl (*Tyto alba*)	P			–
Great Horned Owl (*Bubo virginianus*)	P	–		–
Lesser Nighthawk (*Chordeiles acutipennis*)	B	–		–
Common Nighthawk (*C. minor*)	N	–		–
Common Poorwill (*Phalaenoptilus nuttallii*)	N	–		*
Vaux's Swift (*Chaetura vauxi*)	N	–		
Black-chinned Hummingbird (*Archilochus alexandri*)	B	*	*	*
Anna's Hummingbird (*Calypte anna*)	P	*		*
Rufous Hummingbird (*Selasphorus rufus*)	N	*		
Belted Kingfisher (*Ceryle alcyon*)	P	–	–	–
Acorn Woodpecker (*Melanerpes formicivorus*)	P	–		
Red-breasted Sapsucker (*Sphyrapicus ruber*)	W	–		
Nuttall's Woodpecker (*Picoides nuttallii*)	P	18	2	10
Downy Woodpecker (*P. pubescens*)	P	15	5	3
Red-shafted Flicker (*Colaptes auratus*)	I	10	–	4
Western Wood-Pewee (*Contopus sordidulus*)	B	20	–	–
Willow Flycatcher (*Empidonax traillii*)	N	102	32	12

Table 2 *(Continued)*

Species	Status[b]	Sacramento River NWR	Cosumnes Preserve	San Luis NWR
Hammond's Flycatcher (*E. hammondii*)	N	–		
Dusky Flycatcher (*E. oberholseri*)	N	2		
Gray Flycatcher (*E. wrightii*)	N			1
Pacific-slope Flycatcher (*E. difficilis*)	B, N[e]	29	82	13
Black Phoebe (*Sayornis nigricans*)	P	20	7	6
Ash-throated Flycatcher (*Myiarchus cinerascens*)	B	5	–	2
Western Kingbird (*Tyrannus verticalis*)	B	–	–	–
Loggerhead Shrike (*Lanius ludovicianus*)	I	–		1
Cassin's Vireo (*Vireo cassinii*)	N	1	2	1
Hutton's Vireo (*V. huttoni*)	P	–	5	2
Warbling Vireo (*V. gilvus*)	N	3	6	2
Western Scrub-Jay (*Aphelocoma californica*)	P	3	5	2
Yellow-billed Magpie (*Pica nuttalli*)	P	–	–	–
American Crow (*Corvus brachyrhynchos*)	P	–	–	–
Tree Swallow (*Tachycineta bicolor*)	N	–		–
Violet-green Swallow (*T. thalassina*)	N	–		
Barn Swallow (*Hirundo rustica*)	B	–	–	
Cliff Swallow (*H. pyrrhonota*)	B		–	
Oak Titmouse (*Baeolophus inornatus*)	P	47	6	–
Bushtit (*Psaltriparus minimus*)	P	83	69	127
Red-breasted Nuthatch (*Sitta canadensis*)	W	–	–	–
White-breasted Nuthatch (*S. carolinensis*)	P	1	–	–
Brown Creeper (*Certhia americana*)	W	2		
Bewick's Wren (*Thryomanes bewickii*)	P	188	32	94
House Wren (*Troglodytes aedon*)	S	38	59	52
Winter Wren (*T. troglodytes*)	W	3	1	1
Marsh Wren (*Cistothorus palustris*)	P		2	7
Golden-crowned Kinglet (*Regulus satrapa*)	W	2	1	–
Ruby-crowned Kinglet (*R. calendula*)	W	302	102	79
Blue-gray Gnatcatcher (*Polioptila caerulea*)	N	2	1	4
Western Bluebird (*Sialia mexicana*)	I	2		
Swainson's Thrush (*Catharus ustulatus*)	N	2	–	–
Hermit Thrush (*C. guttatus*)	W	69	60	44
American Robin (*Turdus migratorius*)	I	1	–	–
Varied Thrush (*Ixoreus naevius*)	W	–		
Wrentit (*Chamaea fasciata*)	P	1	39	–
Northern Mockingbird (*Mimus polyglottos*)	P	–		2
California Thrasher (*Toxostoma redivivum*)	P			5
European Starling (*Sturnus vulgaris*)	P	–	–	–
American Pipit (*Anthus rubescens*)	W	–		
Cedar Waxwing (*Bombycilla cedrorum*)	W	–	–	
Orange-crowned Warbler (*Vermivora celata*)	N[f]	259	32	49
Nashville Warbler (*V. ruficapilla*)	N	21	1	1
Yellow Warbler (*Dendroica petechia*)	N[g]	325	9	22
Myrtle Warbler (*D. coronata coronata*)	W	24	1	1
Audubon's Warbler (*D. c. auduboni*)	W	168	3	18
Black-throated Gray Warbler (*D. nigrescens*)	N	2	–	2
MacGillivray's Warbler (*Oporornis tolmiei*)	N	55	16	3
Common Yellowthroat (*Geothlypis trichas*)	I	29	106	17
Wilson's Warbler (*Wilsonia pusilla*)	N	25	63	12

Table 2 *(Continued)*

Species	Status[b]	Sacramento River NWR	Cosumnes Preserve	San Luis NWR
Yellow-breasted Chat (*Icteria virens*)	B	5	3	
Western Tanager (*Piranga ludoviciana*)	N	6	2	_
Spotted Towhee (*Pipilo maculatus*)	P	74	63	43
California Towhee (*P. crissalis*)	P	12	1	6
Rufous-crowned Sparrow (*Aimophila ruficeps*)	W	_		
Chipping Sparrow (*Spizella passerina*)	N		1	
Brewer's Sparrow (*S. breweri*)	M			1
Lark Sparrow (*Chondestes grammacus*)	I	_	9	2
Savannah Sparrow (*Passerculus sandwichensis*)	W	_	2	8
Fox Sparrow (*Passerella iliaca*)	W	4	80	22
Song Sparrow (*Melospiza melodia*)	I, W[h]	32	65	32
Lincoln's Sparrow (*M. lincolnii*)	W	104	106	88
Puget Sound White-crowned Sparrow (*Zonotrichia leucophrys pugetensis*)	W	11	2	
Gambel's White-crowned Sparrow (*Z. l. gambelii*)	W	21	74	240
Golden-crowned Sparrow (*Z. atricapilla*)	W	21	73	35
Dark-eyed Junco (*Junco hyemalis*)	W	19	_	4
Black-headed Grosbeak (*Pheucticus melanocephalus*)	B	2	1	1
Blue Grosbeak (*Guiraca caerulea*)	B	_		1
Lazuli Bunting (*Passerina amoena*)	B	8	7	_
Red-winged Blackbird (*Agelaius phoeniceus*)	P	_	_	_
Western Meadowlark (*Sturnella neglecta*)	P	_	_	_
Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*)	P			_
Brewer's Blackbird (*Euphagus cyanocephalus*)	P	_	_	_
Brown-headed Cowbird (*Molothrus ater*)	I	_	1	_
Bullock's Oriole (*Icterus bullockii*)	B	_	1	
Purple Finch (*Carpodacus purpureus*)	W			_
House Finch (*C. mexicanus*)	P	26	69	8
Pine Siskin (*Carduelis pinus*)	W	_		
Lesser Goldfinch (*C. psaltria*)	P	20	2	_
American Goldfinch (*C. tristis*)	P	14	414	64
House Sparrow (*Passer domesticus*)	P			_

[a]—, species detected only by area searches; *, species captured but released unbanded.

[b]P, permanent resident; I, found year round in Central Valley with fall movement including winter influx; M, winters in North America but probably only passes through Central Valley; N, neotropical migrant passing through but not breeding in Central Valley; B, neotropical migrant breeding in Central Valley; S, short-distance migrant occurring in Central Valley primarily in summer; W, winter only (Gaines 1977, Grinnell and Miller 1944, Natl. Geo. 1999, PRBO unpubl. data).

[c]California threatened species; this neotropical migrant winters rarely in the Central Valley (Sibley 2000).

[d]California endangered species; among our study areas, currently breeds only at the Sacramento River sites.

[e]Currently only a rare breeder in the Central Valley; at our study sites bred in very reduced numbers at one Cosumnes site only, where local extirpation was likely during this period.

[f]Some individuals likely overwinter (Sogge et al. 1994, PRBO unpubl. data).

[g]Historical breeder; most likely extirpated from Central Valley sites but may be returning to the Sacramento River NWR sites as of 1999.

[h]Permanent resident and breeder at San Luis and Cosumnes; none currently breed at the Sacramento River sites, but migrants occur during fall and winter.

status categories). Migrants with the highest ratio of young to adults were the Myrtle Warbler, Audubon's Warbler, and Pacific-slope Flycatcher; those with the lowest ratios were Lincoln's Sparrow and Yellow Warbler.

At the Cosumnes River Preserve, we captured 1774 individuals (74.6 birds per 100 net hours) (Table 1). A total of 81 species was detected with both census methods combined (Tables 2 and 3). The American Goldfinch, Common Yellowthroat, and Lincoln's Sparrow were the species captured most frequently. Capture rates were highest for residents. Migrants with the highest ratio of young to adults were the Pacific-slope and Willow Flycatchers; those with lowest ratios were the Orange-crowned Warbler and Hermit Thrush.

At San Luis National Wildlife Refuge, we captured 1164 birds (32.0 birds per 100 net hours) (Table 1). A total of 96 species was detected with both census methods (Tables 2 and 3). Gambel's White-crowned Sparrow and Bushtit were the species most frequently captured. Capture rates were highest for wintering birds (Table 1). Migrants with the lowest ratio of young to adult were the Fox and Lincoln's Sparrows; no migrant fitting our criteria for sample size and proportion aged had a high age ratio.

Figure 2 presents the capture rates by week for 11 migratory species in regions where sample sizes were sufficient. Among five species (Willow Flycatcher, Orange-crowned Warbler, Lincoln's Sparrow, Gambel's White-crowned Sparrow, and Golden-crowned Sparrow), peak capture rates were earlier at northern sites than at southern sites.

We recaptured in a year after the initial capture individuals of six species that do not breed in the Central Valley (Table 4). Five of the species winter commonly in the Central Valley; the sixth (Orange-crowned Warbler) is predominantly a migrant through the valley, but some individuals overwinter (Sogge et al. 1994). All of these individuals were recaptured at the same banding site, and one-third at the same net location, where they were originally caught. Approximately half were initially banded as young birds. Only one, a Lincoln's Sparrow at the Sacramento River, was captured in three consecutive years.

DISCUSSION

Riparian woodland is important breeding habitat for many resident and migrant landbirds, supporting greater diversity and abundance than any other habitat in California (Miller 1951, Gaines 1977, RHJV 2000). Loss and destruction of riparian habitat have been identified as among the main causes of landbirds' population declines in western United States (DeSante and George 1994). A better understanding of the role of this endangered habitat in all aspects of landbird biology will help ensure that efforts to protect, restore, and enhance it continue. By detailing the extensive use of these study sites by many migrant, resident, and wintering birds in regions where little or no other native habitat is available, our data further emphasize the importance of riparian vegetation in the Central Valley.

From normal clutch sizes and survival rates, Ralph (1971) maintained that the normal ratio of young to adults of a landbird in fall migration should be between 1:1 and 4:1 and that ratios outside that range reflect age classes'

Table 3 Mist-Net Capture Data from Three Central Valley Riparian Sites[a]

	Sacramento River NWR				Cosumnes Preserve				San Luis NWR			
Species	Capture Rate	Range	Age Ratio	% Aged	Capture Rate	Range	Age Ratio	% Aged	Capture Rate	Range	Age Ratio	% Aged
Sharp-shinned Hawk	0.05	0–0.21	2.0	100%	0.04	0–0.1	0	100%	0.05	0–0.15	0	100%
Nuttall's Woodpecker	0.32	0.10–0.47	1.1	94%	0.08	0–0.18	0	50%	0.27	0.20–0.30	3.0	80%
Downy Woodpecker	0.26	0.12–0.43	0.6	87%	0.21	0–0.55	0.5	60%	0.08	0–0.15	2.0	100%
Red-shafted Flicker	0.18	0.07–0.41	0.4	70%	0			0.11	0.08–0.15	1.0	100%	
Western Wood-Pewee	0.35	0–0.74	2.3	100%	0				0			
Willow Flycatcher	1.79	0.93–2.82	2.5	100%	1.35	0.37–2.66	14.5	97%	0.33	0.10–0.61	11:0	92%
Dusky Flycatcher	0.04	0–0.13	2:0	100%	0				0			
Gray Flycatcher	0				0				0.03	0–0.08	1:0	100%
Pacific-slope Flycatcher	0.51	0.14–0.87	6.3	100%	3.45	2.58–4.96	19.3	99%	0.36	0.23–0.45	11.0	92%
Unidentified *Empidonax*	0				0.04	0–0.12	0	100%	0			
Black Phoebe	0.35	0.14–0.61	1.60	65%	0.29	0–0.41	1.5	71%	0.16	0–0.08	0.2	100%
Ash-throated Flycatcher	0.09	0–0.20	1.50	100%	0				0.05	0–0.15	1.0	100%
Loggerhead Shrike	0				0				0.03	0–0.08	0	100%
Cassin's Vireo	0.02	0–0.07	1:0	100%	0.08	0–0.12	1.0	100%	0.03	0–0.10	1:0	100%
Hutton's Vireo	0				0.21		3.0	80%	0.05	0–0.08	2:0	100%
Warbling Vireo	0.05	0–0.20	3:0	100%	0.25	0–0.69	6:0	100%	0.05	0–0.08	2:0	100%
Western Scrub-Jay	0.05	0–0.23	2.00	100%	0.21	0–0.35	1.5	100%	0.05	0–0.15	1.0	100%
Oak Titmouse	0.82	0.71–1.51	1.4	66%	0.25	0.18–0.35	0.5	100%	0			
Bushtit	1.45	0.57–2.55	11.7	46%	2.90	1.27–5.69	3.3	49%	3.49	2.59–5.03	8.5	45%
White-breasted Nuthatch	0.02	0–0.12	1:0	100%	0				0			
Brown Creeper	0.04	0–0.10	2:0	100%	0				0			
Bewick's Wren	3.29	2.75–4.88	7.2	74%	1.35	1.28–1.50	22.0	72%	2.58	2.40–3.01	5.9	73%
House Wren	0.67	0.34–1.02	6.0	92%	2.48	2.27–2.89	7.0	95%	1.43	1.05–1.98	3.4	77%
Winter Wren	0.05	0–0.13	2.0	100%	0.04	0–0.18	1:0	100%	0.03	0–0.08		0%
Marsh Wren	0				0.08	0–0.12	1.0	100%	0.19	0.08–0.40	1.0	86%
Golden-crowned Kinglet	0.04	0–0.10		0%	0.04	0–0.18	1:0	100%	0			
Ruby-crowned Kinglet	5.29	2.21–8.32	5.5	9%	4.29	3.12–5.88	1.3	9%	2.17	1.00–3.23	1.3	9%
Blue-gray Gnatcatcher	0.04	0–0.10	2:0	100%	0.04	0–0.12	1:0	100%	0.11	0–0.23	1:0	25%
Western Bluebird	0.04	0–0.07	1.0	100%	0				0			
Swainson's Thrush	0.04	0–0.13	2:0	100%	0				0			
Hermit Thrush	1.21	0.72–1.93	4.9	86%	2.52	2.02–2.68	6.5	100%	1.21	0.70–1.73	3.0	100%
American Robin	0.02	0–0.07	1:0	100%	0				0			
Wrentit	0.02	0–0.10		0%	1.64	0.73–2.20	4.8	90%	0			

Northern Mockingbird	0				0				0.05	0–0.15		0%
California Thrasher	0				0				0.14	0.08–0.30	4:0	80%
Orange-crowned Warbler	4.53	1.43–10.33	3.3	77%	1.35	0.81–3.12	5.8	84%	1.35	1.00–1.52	5.0	61%
Nashville Warbler	0.37	0–0.74	1.7	90%	0.04	0–0.12	1:0	100%	0.03	0–0.08	1:0	100%
Yellow Warbler	5.69	1.86–9.79	1.1	80%	0.38	0.21–0.55	1.7	89%	0.60	0.30–1.07	2.20	73%
Myrtle Warbler	0.42	0–0.61	9.5	88%	0.04	0–0.18	1:0	100%	0.03	0–0.10		0%
Audubon's Warbler	2.94	2.03–4.29	6.4	84%	0.13	0–0.23	0	67%	0.49	0.38–0.70	7.0	89%
Black-throated Gray Warbler	0.04	0–0.07	2:0	100%	0				0.05	0–0.15	2:0	100%
MacGillivray's Warbler	0.96	0.36–1.68	1.7	98%	0.67	0.18–0.83	2.2	100%	0.08	0–0.15	0.5	100%
Common Yellowthroat	0.51	0.2–0.82	4.4	93%	4.46	3.20–5.90	3.1	89%	0.47	0.30–0.61	4.0	88%
Wilson's Warbler	0.44	0.20–0.60	4.8	92%	2.65	1.62–4.77	7.6	95%	0.33	0.15–0.60	0.8	75%
Yellow-breasted Chat	0.09	0–0.13	4.0	100%	0.13	0–0.23	2.0	100%	0			
Western Tanager	0.11	0–0.20	0.5	100%	0.08	0–0.18	2:0	100%	0			
Spotted Towhee	1.30	0.92–2.05	1.7	99%	2.65	1.47–3.35	2.2	92%	1.18	1.10–1.37	1.1	98%
California Towhee	0.21	0–0.40	1.2	92%	0.04	0–0.12	1:0	100%	0.16	0–0.38	6:0	100%
Chipping Sparrow	0				0.04	0–0.10	1:0	100%	0			
Brewer's Sparrow	0				0				0.03	0–0.08	1:0	100%
Lark Sparrow	0				0.38	0–0.62	8.0	100%	0.05	0–0.15	1:0	50%
Savannah Sparrow	0				0.08	0–0.12	2:0	100%	0.22	0.08–0.50	3.0	100%
Fox Sparrow	0.07	0–0.23	4:0	100%	3.36	1.10–6.09	2.8	100%	0.60	0.68–0.70	1.2	100%
Song Sparrow	0.56	0.27–1.02	3.0	88%	2.73	1.96–4.51	1.6	95%	0.88	0.30–1.30	2.2	100%
Lincoln's Sparrow	1.82	0.61–3.07	0.8	100%	4.46	0.55–5.88	2.0	100%	2.42	1.30–4.12	1.2	99%
Unidentified White-crowned Sparrow	0.05	0–0.10	0	100%	1.98	0–2.58	8.4	100%	0.22	0–0.53	1.7	100%
Puget Sound White-crowned Sparrow	0.19	0.07–0.71	0.6	100%	0.08	0–0.23	2:0	100%	0			
"Gambel's" White-crowned Sparrow	0.37	0–0.80	3.2	100%	3.11	0.55–4.28	6.4	100%	6.59	4.58–9.76	1.6	100%
Golden-crowned Sparrow	0.37	0.13–0.58	1.1	100%	3.07	0–4.13	3.7	97%	0.96	0.40–1.75	1.9	100%
Dark-eyed Junco	0.33	0–0.40	1.8	74%	0				0.11	0–0.23	3:0	75%
Black-headed Grosbeak	0.04	0–0.20	1.0	100%	0.04	0–0.10	1:0	100%	0.03	0–0.10	1:0	100%
Blue Grosbeak	0				0				0.03	0–0.08	1:0	100%
Lazuli Bunting	0.14	0–0.40	1.7	100%	0.29	0–0.69	2.5	100%	0			
Brown-headed Cowbird	0				0.04	0–0.18	1:0	100%	0			
Bullock's Oriole	0				0.04	0–0.12	1:0	100%	0			
House Finch	0.46	0–1.07	0.9	92%	2.90	0–4.74	1.7	99%	0.22	0.08–0.30	4.0	63%
Lesser Goldfinch	0.35	0–0.80	1.2	100%	0.08	0–0.23	2:0	100%	0			
American Goldfinch	0.25	0–0.87	0.6	100%	17.4	1.65–41.86	5.3	94%	1.76	0.53–3.13	0.7	95%

[a]Capture rate is per 100 net hours, range is of annual capture rate, age ratio of captures is young/adult birds, and % aged is percent of banded individuals that were aged.

Table 4 Recaptures in Subsequent Years of Migrants or Winter Visitors

Species	Region	Number originally banded[a]	Number captured in multiple years	Percent captured in multiple years
Ruby-crowned Kinglet				
	Sacramento River NWR	271	2	0.7%
	San Luis NWR	53	1	1.9%
Orange-crowned Warbler				
	Sacramento River NWR	231	4	1.7%
	Cosumnes Preserve	25	1	4%
Fox Sparrow				
	Cosumnes Preserve	64	3	4.7%
	San Luis NWR	14	3	21.4%
Golden-crowned Sparrow				
	Cosumnes Preserve	40	2	5%
	San Luis NWR	13	1	7.7%
Gambel's White-crowned Sparrow				
	San Luis NWR	117	7	6.0%
Lincoln's Sparrow				
	Sacramento River NWR	87	2	2.3%
	San Luis NWR	34	1	2.9%

[a]Number of birds banded prior to the final year of mist-netting, i. e., individuals that could have been recaptured in subsequent years of the study.

using an area disproportionately. Ralph also (1981), finding that the proportion of young birds among fall migrants on the east coast of the U.S. is higher than inland, suggested that this "coastal effect" implies the coast is on the periphery of many species' migration route and that lower age ratios inland may indicate the primary migration route. In California, Stewart et al. (1974) also found ratios of young to adults lower inland than at coastal and island sites. We found age ratios to be 2 to 19 times lower at our inland sites than on the coast (Taylor et al. 1994) for 10 of 11 species examined (Table 5). Of particular interest are the low age ratios of some neotropical migrants (e.g., Nashville Warbler and MacGillivray's Warbler; see also Table 5), particularly at our Sacramento River sites. On the coast such ratios are disproportionately biased toward young birds (Taylor et al. 1994). These findings suggest that the Central Valley may be a primary migratory corridor for some species and further support the theory of a "coastal effect" in California.

While age ratios can provide useful insights into migration, they may misrepresent the use of a migratory corridor or stopover site by age groups if individuals of one age group stop more frequently or for longer periods of time, or if either group migrates predominantly outside the period monitored, a pattern observed in some species (Weston 1947, Stewart et al. 1974). As we operated our banding sites during the summer as well (with nets run once every 10 days until the onset of fall migration monitoring), we were able to address the latter consideration by examining data recorded before we began

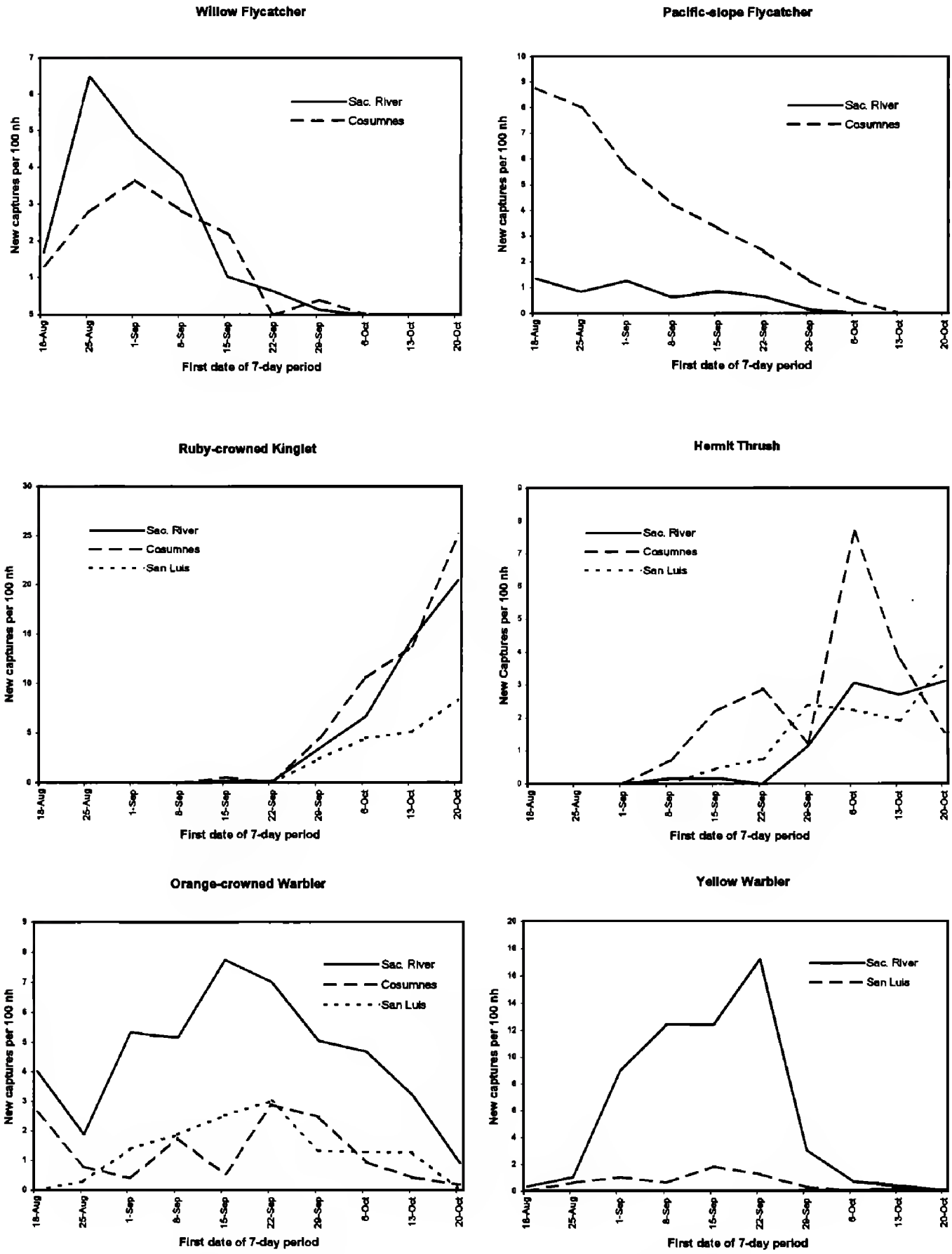


Figure 2. Dates of fall captures of select migrants in the Central Valley.

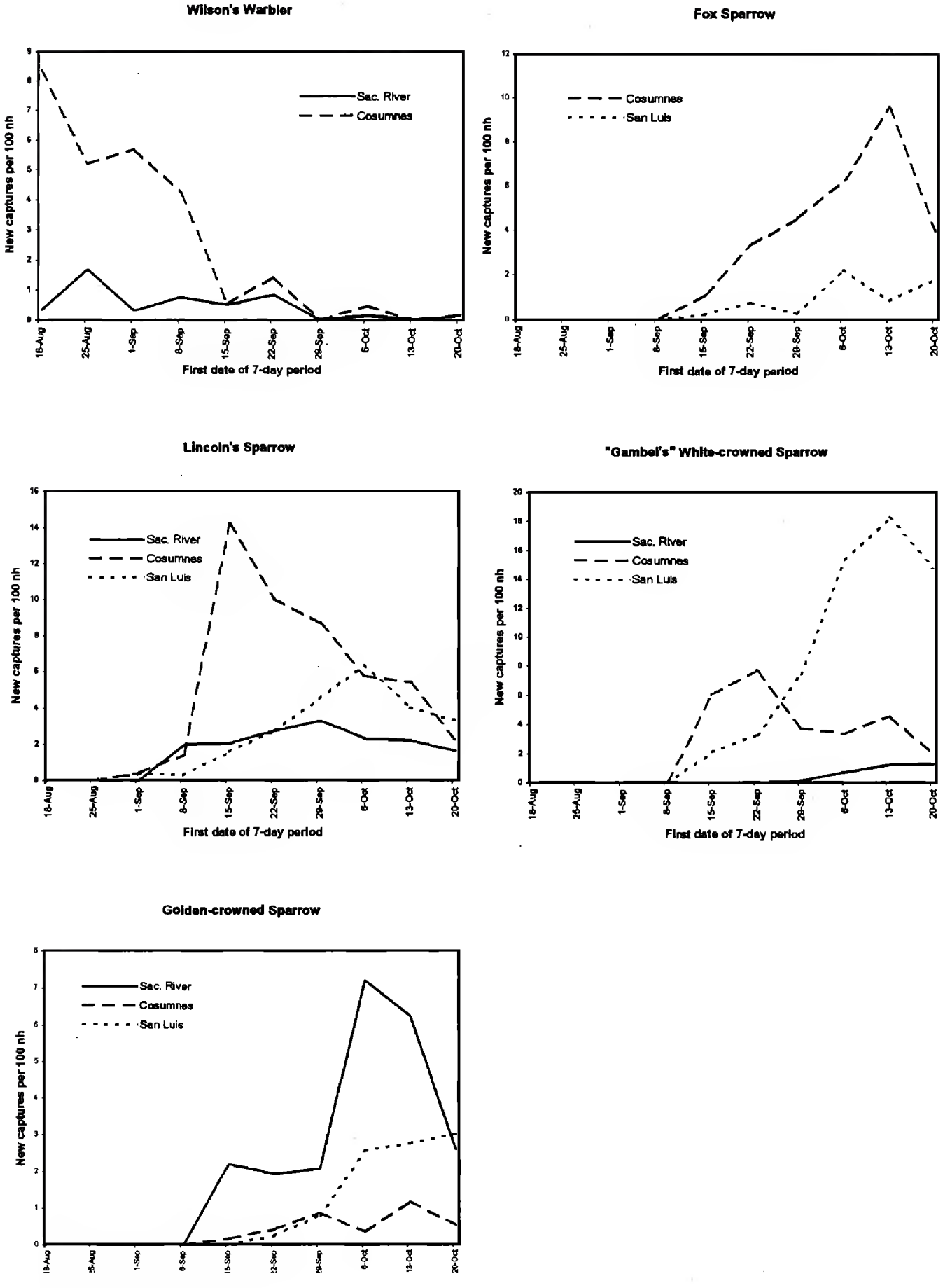


Figure 2 (*Continued*)

Table 5 Comparison of Age Ratios[a] of Fall Migrants Netted at One Coastal and Three Central Valley Sites

	Site			
Species	Palomarin, Marin Co.[b]	Sacramento R. NWR	Cosumnes Preserve	San Luis NWR
Western Wood-Pewee	6.8	2.3[c]	—	—
Willow Flycatcher	30.0	2.5 (2.0, *n* = 109)	14.5	—
Pacific-slope Flycatcher	60.9	6.3 (2.6, *n* = 43)	19.3 (12.2, *n* = 119)	—
Hermit Thrush	44.7	4.9	6.5	3.0
Orange-crowned Warbler	6.3	—	5.8 (5.2, *n* = 31)	—
Yellow Warbler	4.9	1.1 (1.1, *n* = 268)	—	—
Myrtle Warbler	2.8	9.5	—	—
Audubon's Warbler	3.3	6.4	—	—
Wilson's Warbler	18.0	4.8 (4.2, *n* = 31)	7.6 (6.3, *n* = 88)	—
Fox Sparrow	5.5	—	2.8	1.2
Lincoln's Sparrow	11.2	0.8	2.0	1.2
Golden-crowned Sparrow	6.0	1.1	3.7	1.9

[a]Young/adult. Presented only for species and sites with at least 20 individuals of known age 20 captured (Central Valley sites), 3 or more captures annually at Palomarin, and for which >80% of individuals captured in the Central Valley were of known age. We present in parentheses age ratios and sample sizes of known-aged birds after inclusion of captures prior to the initiation of fall-migration monitoring (18 August); species with no such data presented were not captured before fall monitoring.

[b]Data from 1976 to 1986, 18 August to 25 November (Taylor et al. 1994).

[c]Migrants prior to 18 August not examined because local breeders confound the data set.

our fall regime. We did this for all migrants of which we had an autumn sample size of at least 20 individuals in a region. Including these preseason data reduced age ratios slightly for the Willow Flycatcher and Wilson's Warbler at the Sacramento River and for the Orange-crowned and Wilson's Warblers at Cosumnes River. It reduced them more substantially for the Pacific-slope Flycatcher in both regions (Table 5), indicating early movement of adults of this species. For all other species age ratios were unchanged.

Of particular interest is the number of Willow Flycatchers, Yellow Warblers, and Song Sparrows at these Central Valley sites, all species of current conservation interest in California where they have been extirpated from parts of their breeding range (Gaines 1974; see RHJV 2000 for review). The high capture rate of the Pacific-slope Flycatcher at the Cosumnes River Preserve also merits note. Stewart et al. (1974) suggested that this species migrates primarily along the coast, yet our capture rate at Cosumnes from 1995 to 1997 was nearly twice as high as it was at the Palomarin Field Station on the coast of Marin County from 1976 to 1986 (Taylor et al. 1994) and 1.5 times as high as the capture rate at Palomarin from 1995 to 1997 (PRBO unpubl. data). It appears that this inland Central Valley route is widely used by the Pacific-slope Flycatcher. While the ratios of young to adults for this species were high at both sites, adult Pacific-slope Flycatchers were relatively more common at Cosumnes than at Palomarin, and the age ratio was low at the Sacramento River (Table 5; Taylor et al. 1994). This

suggests that more adult flycatchers migrate through the Central Valley than down the coast, although even more adults likely migrate along unexamined routes.

Different suites of species varied considerably in their relative abundance between study areas. Neotropical migrants were most abundant at the Sacramento River National Wildlife Refuge sites, year-round residents at the Cosumnes River Preserve, and wintering birds at the San Luis National Wildlife Refuge. Also at the Cosumnes River Preserve (which had the highest capture rate of all three regions), permanent residents were captured at a rate at least three times greater than in the other two regions. The total list of species recorded being greatest at the Sacramento River may reflect only the greater number of seasons we monitored there. Because we were more interested in describing fall composition of the birdlife at each of these sites than in comparing the sites to one another we did not limit the scope of this paper to only 1995 to 1997. Our results also show that for most species examined year-to-year return rates of wintering individuals were highest at San Luis, suggesting not only high use of this site by wintering species but the suitability of this site as well.

Pooling results of area searches and mist-netting captures yielded higher species counts than either method alone, providing a more complete picture of birds' use of these sites. All regions combined, 22 passerines, including the European Starling, blackbirds, swallows, and corvids, were never captured in mist-nets but were detected on area searches, along with most nonpasserines. Other species, often uncommon or reticent ones, were captured in mist nets but never detected on area searches. Such species were the Dusky Flycatcher, Brown Creeper, and Yellow-breasted Chat at the Sacramento River, the Winter Wren, Yellow-breasted Chat, Chipping Sparrow, Lark Sparrow, Savannah Sparrow, and Lesser Goldfinch at the Cosumnes Preserve, and the Common Poorwill, Gray Flycatcher, Hutton's Vireo, Warbling Vireo, Nashville Warbler, Myrtle Warbler, MacGillivray's Warbler, Brewer's Sparrow, and Black-headed Grosbeak at San Luis. Such sampling differences are even more pronounced when only a single site is considered. We recommend that other migration studies supplement mist netting with additional census methods to describe and monitor bird communities, as ours and other studies have done (Pyle and Henderson 1991, Finch and Yong 2000).

Because these studies lasted only a few years (2 to 5 years at each site), results may not reflect average numbers of species using the habitat or region. Annual numbers of fall migrants recorded in long-term studies at Palomarin (Taylor et al. 1994) and on Southeast Farallon Island off the California coast (DeSante 1983) are highly variable, so short-term fall migration monitoring may underestimate or exaggerate an area's importance as a stopover site by a species or suite of species. Nevertheless our data establish the use of the remaining riparian habitat in the Central Valley by western landbirds during autumn, including resident, migrant and wintering species. In a region lacking continuous, wide stretches of riparian habitat, where the surrounding landscape often lacks substantial vegetative structure, and in the absence of any other large forest patches (Petit 2000), these and other remnant sites of varying quality are likely important for migrating birds.

ACKNOWLEDGMENTS

We are indebted to the many interns, volunteers, and staff of PRBO and the U.S. Fish and Wildlife Service who helped collect data presented here. We thank Grant Ballard, Jim DeStaebler, Denise Hardesty, Sacha Heath, Anne King, Mike Lynes, Rhonda Millikin, Nadav Nur, C. J. Ralph, Stacy Small, and Rob Willis for their consultation, guidance, and support of the study. Mark Sogge, Ted Beedy, Sid England, Tom Gardali, Ryan Burnett, and Philip Unitt provided helpful comments on the manuscript. We also thank the following friends, staff, and institutions for support, access, and invaluable assistance on the project: Sara Blanchett, John Carlon, Mike Eaton, Gregg Elliott, Sam Lawson, Daryl Peterson, Rich Riener, Ramona Swenson, and Dawiet Zeleke of the Nature Conservancy (Cosumnes River Preserve and Sacramento River Project), Rick Cooper of the Bureau of Land Management (Cosumnes River Preserve), and Tina Chouinard, Greg Mensik, Mike Peters, Ramon Vega, Joe Silveira, Dennis Woolington, and Tara Zimmerman of the U.S. Fish and Wildlife Service. Financial support was provided by the David and Lucille Packard Foundation, the Nature Conservancy, U.S. Fish and Wildlife Service, the National Fish and Wildlife Foundation, the Dean Witter Foundation, and the William and Flora Hewlett Foundation. This is PRBO contribution 967.

LITERATURE CITED

Cogswell, H. L. 1962. Operation recovery begun in California's Central Valley. W. Bird Bander 37:52–54.

DeSante, D. F. 1983. Annual variability in the abundance of migrant landbirds on Southeast Farallon Island, California. Auk 100:826–852.

DeSante, D. F., and George, T. L. 1994. Population trends in the landbirds of western North America. Studies Avian Biol. 15:173–190.

Finch, D. M., and Yong, W. 2000. Landbird migration in riparian habitats of the middle Rio Grande: A case study. Studies Avian Biol. 20:88–98.

Gaines, D. 1974. A new look at the nesting riparian avifauna of the Sacramento Valley, California. W. Birds 5:61–80.

Gaines, D. F. 1977. The valley riparian forests of California: Their importance to bird populations, *in* Riparian Forests in California: Their Ecology and Conservation (A. Sands, ed.), pp. 57–85. Inst. Ecol. Publ. 15, Univ. Calif., Davis.

Grinnell, J., and Miller, A. H. 1944. The distribution of the birds of California. Pac. Coast Avifauna 27.

Katibah, E. F. 1984. A brief history of riparian forests in the Central Valley of California, *in* California Riparian Systems: Ecology, Conservation, and Productive Management (R. E. Warner and K. M. Hendrix, eds.). Univ. Calif. Press, London.

Miller, A. H. 1951. An analysis of the distribution of the birds of California. Univ. Calif. Publ. Zool. 50:531–643.

National Geographic Society. 1999. Field Guide to the Birds of North America, 3rd ed. Natl. Geogr. Soc., Washington, D.C.

Petit, D. R. 2000. Habitat use by landbirds along nearctic–neotropical migration routes: Implications for conservation of stopover habitats. Studies Avian Biol. 20:15–33.

Pyle, P., and Henderson, R. P. 1991. The birds of Southeast Farallon Island: Occurrence and seasonal distribution of migratory species. W. Birds 22:41–84.

Pyle, P., Howell, S. N. G., Yunick, R. D., and DeSante, D. 1987. Identification Guide to North American Passerines. Slate Creek Press, Bolinas, CA.

Ralph, C. J. 1971. An age differential of migrants in coastal California. Condor 73:243–246.

Ralph, C. J. 1981. Age ratios and their possible use in determining autumn routes of passerine migrants. Wilson Bull. 93:164–188.

Ralph, C. J., Geupel, G. R., Pyle, P., Martin, T. E., and DeSante, D. F. 1993. Field methods for monitoring landbirds. U.S. Dept. Agric. Forest Serv. Publ. PSW-GTR 144, Albany, CA (order from Pacific Southwest Research Station, P. O. Box 245, Berkeley, CA 94701-0245).

RHJV (Riparian Habitat Joint Venture). 2000. Version 1.0. The Riparian Bird Conservation Plan: A Strategy for Reversing the Decline of Riparian Associated Birds in California. California Partners in Flight (request from Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach CA 94970; also available at http://www.prbo.org/CPIF/Riparian/Riparian.html).

Sibley, D. A. 2000. The Sibley Guide to Birds. Knopf, New York.

Slater, P. J. 1994. Factors affecting the efficiency of the area search method of censusing birds in open forests and woodlands. Emu 94:9–16.

Sogge, M. K., Gilbert, W. M., and van Riper III, C. 1994. Orange-crowned Warbler (*Vermivora celata*), *in* The Birds of North America (A. Poole and F. Gill, eds.), no. 101. Acad. Nat. Sci., Philadelphia.

Stewart, R. M., Mewaldt, L. R., and Kaiser, S. 1974. Age ratios of coastal and inland fall migrant passerines in central California. Bird-Banding 45:46–57.

Taylor, D. M., DeSante, D. F., Geupel, G. R., and Houghton, K. 1994. Autumn populations of landbirds along central coastal California, 1976–1986. J. Field Ornithol. 65:169–185.

Weston, H. G. 1947. Breeding behavior of the Black-headed Grosbeak. Condor 49:54–73.

Accepted 4 September 2001

WINTER FORAGING HABITAT OF GREATER SANDHILL CRANES IN NORTHERN CALIFORNIA

CARROLL D. LITTLEFIELD, P. O. Box 44, Rodeo, New Mexico, 88056

ABSTRACT: In the upper Butte basin (Butte, Colusa, Glenn, and Sutter counties) of California's Sacramento Valley, wintering Greater Sandhill Cranes select unaltered harvested rice stubble most consistently for foraging. They feed in burned and flooded rice stubble for brief periods; their use of such fields decreases dramatically by January and remains low thereafter. Few cranes forage in rice stubble disked in autumn. Recently planted winter wheat attracts large numbers of cranes from the time of planting until shortly after seedling emergence but not after early January. Disked corn stubble is used sporadically, primarily in late January and February just before cranes migrate in spring. Grazed grasslands also support cranes, mostly after the onset of winter rains. Foraging habitat for cranes in the basin is currently ample, but continuing changes in agricultural practices may result in future food shortages.

The Central Valley population is the westernmost of the five recognized populations of the Greater Sandhill Crane (*Grus canadensis tabida*) (Drewien and Lewis 1987). Birds affiliated with the Central Valley population breed from central interior British Columbia south to northeastern California and winter in California's Central Valley from near Chico, Butte County, southeast to near Delano, Tulare County (Littlefield and Thompson 1979). Cranes were studied in the valley for several winters from 1969 to 1987 (Littlefield and Thompson 1979, 1981, Pogson 1990, Pogson and Lindstedt 1991), but these studies focused primarily on the cranes' distribution, abundance, behavior, and subspecific composition. Few data were collected on winter crane foraging in relation to agriculture. To address this information gap, I studied cranes in the rice-growing region of the upper Butte basin in the northern Central Valley during the winters of 1991–92 and 1992–93. About 6000 Greater Sandhill Cranes wintered there, foraging primarily on agricultural lands while roosting and loafing on nearby wetlands; wetlands were usually on private hunting clubs, state wildlife areas, and the Llano Seco Unit of the Sacramento River National Wildlife Refuge, Butte County (Littlefield 1993).

Sandhill Cranes are omnivores, consuming invertebrates, amphibians, reptiles, small mammals and birds, eggs, and a variety of plant parts (Walkinshaw 1973); waste grains and other seeds are dominant foods in autumn and winter. Waste grains reportedly consumed include milo, wheat, corn (Walkinshaw 1973), rice (Guthery 1972), barley (Drewien and Bizeau 1974), and oats (Madsen 1967). All of these crops were grown in the upper Butte basin, but, in hectares planted, rice far exceeded all others. For example, of 33,908 ha planted to grains in Butte County in 1991, rice accounted for 84.5%, winter wheat 11.7%, barley 2.3%, and corn 1.1% (Butte County Agricultural Crop Report 1992); only two to three small plots of milo and one of oats were known planted. The large amount of rice attracted and supported the majority of wintering cranes; however, their use depended on the status of rice stubble. In this study I assessed the cranes' foraging preferences in the context of agricultural practices. My two principal objectives were to inventory crane numbers in the various foraging

habitats and to assess crane foraging preference or avoidance for specific habitats in relation to farming activities or other land-use regimes.

STUDY AREA AND METHODS

The study area extended from 6.4 km south of Chico south to the Sutter Buttes (39° 10′N, 121° 44′W), east to Highway 99, west to the Sacramento River. Cranes primarily foraged on level terrain with fertile soils, interspersed with rivers and drainage basins. Much of the area was in agricultural production; grains, alfalfa, and beans were important crops, with various orchard types in peripheral zones. Most cranes were found in the western one third of Butte County, with additional birds in northern Sutter, northeastern Colusa, and southeastern Glenn counties. On the basis of weekly mean numbers at roost sites in the winter of 1991–92, 76.6% of the cranes were in Butte, 13.7% in Sutter, and 9.7% in Colusa County, whereas in 1992-93, 79.1% were in Butte, 12.1% in Colusa, and 8.8% in Sutter County. Though few cranes roosted in Glenn County, some birds that roosted in Butte County frequently fed there.

The upper Butte basin is the northernmost region of traditional Sandhill Crane wintering in North America. The climate is Mediterranean, with cool, wet winters and hot, dry summers. Mean January temperature is 5° C (coolest month), whereas the July mean is 23° C (warmest month); fewer than 15 nights each year have temperatures below freezing (Heitmeyer et al. 1989). At Gridley, Butte County, mean annual rainfall is 513 mm (1923–1992), with most of this from November through February (Butte County Joint Water District unpubl. data). Excessive runoff from local rainfall or melting Sierra Nevada snow frequently results in lowland flooding, especially adjacent to the Sacramento River and Butte Creek. During this study, flooding was frequent in 1992–93, only minor and brief in 1991–92.

I recorded crane numbers and foraging habitats for all birds clearly viewed. Most observations were from a vehicle, through 7 × 35 binoculars or a 20× window-mounted spotting scope, but during or shortly after rain I assessed a few sites on foot. Generally I avoided this unless concealing vegetation was sufficient. Cranes are wary of people walking and frequently flew when approached within ca. 400 m; a vehicle usually did not elicit a similar response. I sometimes located foraging areas by observing or following cranes leaving roosting sites in the morning or loafing sites in the afternoon. I located most, however, by driving and scanning from public roads during morning or late afternoon when cranes were feeding. Once located, birds were counted individually, and crop type and land-use regime were recorded. Data collection was nonrandomized because of the road network and in some areas inaccessibility, thus habitat use is expressed as percentage of use (cf. Montgomery 1997). Periods of study were 30 November 1991–26 February 1992 and 18 October 1992–17 February 1993.

To assess the cranes' foraging-habitat preferences and seasonal habitat changes, I censused them weekly along a nonrandomized 77-km transect (Sutter Buttes to Nelson, Butte County) through their major use area between 23 October 1992 and 15 February 1993. I conducted 18 surveys, nine in autumn (23 October–18 December) and nine in winter (25 Decem-

ber–15 February). Agricultural types and land-use practices were recorded on both sides of the transect route at points every 0.8 km, for a total of 186 habitat-data points per census (Table 1). I conducted all censuses between 0730 and 1030 PST, with most beginning about 0745 and ending before 1000. Land-use changes along the transect were frequent in autumn, as farmers burned, flooded, plowed, or planted fields. Thus, for cranes within 1.2 km of the transect route, I calculated foraging habitat-preference indices (HPIs) weekly as percent use/percent habitat availability. Percent use was the number of cranes recorded in a specific habitat type divided by the total number of cranes tallied per census × 100; percent availability was the occurrence of a specific habitat type at data points divided by 186 data points × 100. A HPI of 1 suggests cranes were using a specific habitat type in proportion to its availability; a HPI >1 suggests use higher than expected, whereas a value <1 suggests avoidance (Hoffman 1976).

RESULTS

Seasonal Agricultural Changes

On weekly surveys along the 77-km transect route in 1992–93, as well as throughout the upper Butte basin, farming activity frequently caused habitat changes, particularly in November and December (Littlefield 1993). This was most evident for harvested rice fields, as unaltered stubble decreased from 82% on 23 October to 43% on 19 December. Alterations included stubble disking (plowing), burning, flooding, or combinations of the three (Table 2). Residual wheat stubble decreased from 100% on 30 October to 20% by 18 December; 80% of the wheat fields had been replanted by late December. Most corn stubble was disked before surveys were initiated; two corn fields were later planted with winter wheat. Cropland alteration had mostly stabilized by January. The study began too late in 1991–92 to document habitat changes, but autumn farming activities appeared similar to

Table 1 Land Uses along a 77-km Transect in the Upper Butte Basin, California, 1992–93

Land use	No. points surveyed	Percentage
Rice	77	41.4
Fallow	28	15.1
Plowed	21	11.3
Grassland	15	8.1
Orchard	13	7.0
Alfalfa	11	5.9
Marsh	9	4.8
Wheat	6	3.2
Corn	6	3.2
Total	186	100.0

Table 2 Numbers, Percentage, and Percent Change from Farming Practices in Rice-Stubble Fields at Points Surveyed in the Upper Butte Basin, Autumn 1992

Farming practice	23 October 1992	18 December 1992	Change
Unaltered	63 (82%)	33 (43%)	–39%
Burned	8 (10%)	13 (17%)	+7%
Plowed	6 (8%)	14 (18%)	+10%
Flooded	—	4 (5%)	+5%
Burned and flooded	—	5 (7%)	+7%
Burned and plowed	—	5 (7%)	+7%
Plowed and flooded	—	3 (4%)	+4%
Total	77 (100%)	77 (100%)	

those recorded in 1992–93. Several habitats (e.g., alfalfa, marsh, grassland, orchard) remained unchanged in both winters.

Habitat Use

Of the nearly 70,000 habitat use-days recorded in the study, 33,870 were in the winter of 1991–92 (Table 3) and 36,201 in 1992–93 (Table 4). Harvested rice was the most frequently used habitat; 58% (n = 19,757 use-days) in 1991–92 and 72% (n = 25,953) in 1992-93. Farming practices

Table 3 Sandhill Cranes Counted per Month by Habitat in the Upper Butte Basin, 1991–1992

Habitat and status	December	January	February	Total
Rice stubble				
unaltered	2727 (18.0%)	4789 (46.5%)	2075 (26.6%)	9591 (28.3%)
burned	2516 (16.6%)	767 (7.5%)	932 (11.0%)	4215 (12.4%)
flooded	1564 (10.3%)	294 (2.7%)	107 (1.3%)	1965 (5.8%)
plowed	710 (4.7%)	259 (2.5%)	311 (3.7%)	1280 (3.8%)
burned + flooded	2271 (15.0%)	87 (0.9%)	3 (< 0.1%)	2361 (7.0%)
burned + plowed	278 (1.8%)	—	—	278 (0.8%)
plowed + flooded	47 (0.3%)	6 (0.1%)	14 (0.2%)	67 (0.2%)
Winter wheat	4528 (29.9%)	287 (2.8%)	228 (2.7%)	5043 (14.9%)
Unharvested corn	—	1795 (17.4%)	2177 (25.8%)	3972 (11.7%)
Plowed corn stubble	52 (0.3%)	862 (8.4%)	1213 (14.4%)	2127 (6.3%)
Fallow	264 (1.7%)	799 (7.8%)	822 (9.7%)	1885 (5.6%)
Grassland	179 (1.2%)	350 (3.4%)	300 (3.6%)	829 (2.5%)
Marsh	—	—	197 (2.3%)	197 (0.6%)
Alfalfa	—	—	60 (0.7%)	60 (0.2%)
Total	15,136 (44.7%)	10,295 (30.4%)	8439 (24.9%)	33,870 (100.0%)

Table 4 Sandhill Cranes Counted per Season by Habitat in the Upper Butte Basin, 1992–1993

Habitat and status	Autumn[b]	Winter[c]	Total
Rice stubble			
unaltered	7941 (37.9%)	9659 (63.4%)	17,600 (48.6%)
flooded	5343 (25.5%)	117 (0.8%)	5460 (15.1%)
burned	2035 (9.7%)	351 (2.3%)	2386 (6.6%)
plowed	15 (<0.1%)	190 (1.3%)	205 (0.6%)
burned + flooded	214 (1.0%)	—	214 (0.6%)
plowed + flooded	88 (0.4%)	—	88 (0.2%)
Wheat			
planted	2680 (12.8%)	1249 (8.2%)	3929 (10.9%)
stubble	511 (2.4%)	32 (0.2%)	543 (1.5%)
plowed stubble	106 (0.5%)	—	106 (0.3%)
Plowed corn stubble	694 (3.3%)	1990 (13.1%)	2684 (7.4%)
Grassland	998 (4.8%)	695 (4.6%)	1693 (4.7%)
Alfalfa	34 (0.2%)	324 (2.1%)	358 (1.0%)
Fallow	39 (0.2%)	304 (2.0%)	343 (1.0%)
Plowed fallow	—	197 (1.3%)	197 (0.5%)
Plowed (bare)	128 (0.6%)	37 (0.2%)	165 (0.5%)
Milo	138 (0.7%)	—	138 (0.4%)
Bean	—	77 (0.5%)	77 (0.2%)
Pasture	—	12 (< 0.1%)	12 (<0.1%)
Valley Oak	—	3 (<0.1%)	3 (<0.1%)
Total	20,964 (57.9%)	15,237 (42.1%)	36,201 (100.0%)

[a]Excludes cranes using unharvested corn in Butte County.

[b]18 October–17 December.

[c]18 December–17 February.

frequently influenced the number of cranes using a particular field. Unaltered stubble generally attracted more cranes, especially after the third week of December; 49% of all birds in rice in 1991–92 and 68% in 1992–93. Of the three methods of alteration, disking was the least preferred by cranes, and for both winters combined the cranes accrued only 1485 habitat use-days in plowed fields. On the other hand, both burning and flooding usually resulted in intensive short-term foraging, but cranes generally abandoned these sites soon after stubble was burned, or particularly after a site became flooded. By late December few cranes were foraging in burned or flooded harvested rice fields.

For about 2 to 3 weeks, generally in November and December, recently planted winter wheat was an important but temporary localized food source. In December 1991, 29.9% of the total use was in wheat, but in January and February this figure declined to only 2.8% and 2.7%, respectively (Table 3). Harvested disked corn was third in importance in both winters. Few cranes were noted using corn in November and December, but beginning in January waste corn consumption increased. Birds continued to feed on corn

until they migrated in February. Also, a flooded unharvested 15-ha corn plot on a state wildlife area in Butte County was used daily between 8 January and 25 February 1992 by a mean of 493 cranes (range 398–599). In addition to croplands, cranes fed on Rancho Llano Seco grasslands (ca. 16 km SW of Chico) during and after rain. These cattle-grazed ranges had cranes more frequently in the wetter winter of 1992–93 (1692 use-days) than in the drier winter of 1991–92 (829 use-days).

Cranes generally used the same habitat types in both winters, but there were exceptions. For example, more cranes were found in alfalfa in 1993 (e.g., 262 on 9 February), 77 used a harvested Colusa County bean field in January 1993, and three spent several consecutive days feeding beneath a large Valley Oak (*Quercus lobata*) in Sutter County in February 1993, apparently consuming acorns. However, in both winters, grazed grasslands, harvested rice, recently planted winter wheat, and disked corn stubble provided the majority of crane foraging habitat.

Foraging-Habitat Preferences

Of the 36,201 total crane habitat use-days tallied in 1992–93, 14,678 (40.6%) were along the 77-km transect survey route and were used to calculate weekly HPIs. Of those along the transect, 7207 were in autumn, 7471 in winter. The mean count on the nine autumn censuses was 801, standard deviation (SD) 385, range 312–1596, whereas the mean for the nine winter censuses was 827, SD 317, range 457–1498; the mean for all counts was 815 (SD 342). As throughout the upper Butte basin, unaltered harvested rice stubble was the habitat used most consistently, but burned and flooded rice stubble, recently planted winter wheat, disked corn stubble, and cattle-grazed grasslands were also important; however, crane foraging in these habitats was inconsistent. The HPI in unaltered and burned rice stubble was generally high in autumn (Table 5), but unaltered rice stubble was the principal foraging habitat in winter (Table 6). Flooded harvested rice had a higher-than-expected proportion of foraging cranes between 4 and 13 November 1992 (HPI 5.87), after which its rating dropped precipitously. The HPI for burned rice stubble that was subsequently flooded also demonstrated a similar but brief crane-foraging response. Rice stubble disked shortly after harvest was strongly avoided, reaching its highest HPI of only 0.16 in February; however, a figure of 20.4 (Table 5) was recorded from one disked field being flooded on 13 November 1992. After 13 November, however, no cranes were noted there. Though rice was the most consistently used crop overall, the highest rating for any habitat type was on newly planted winter wheat on 19 (HPI 51.36) and 26 November (HPI 33.36), but this type was little used after early January.

DISCUSSION

The upper Butte basin frequently supports up to 70% of the Central Valley crane population in winter, and it is also an important stopover for cranes migrating to or from wintering regions further south (Pogson and Lindstedt 1991). My study implies that waste rice in harvested fields is these cranes' most important food. Though other agricultural types (particularly recently

Table 5 Weekly Habitat-Preference Indices[a] for Sandhill Cranes along a 77-km Transect through the Upper Butte Basin, 23 October–18 December 1992

Habitat	23 Oct	30 Oct	4 Nov	13 Nov	19 Nov	26 Nov	4 Dec	11 Dec	18 Dec
Rice stubble									
unaltered	1.05	2.22	2.27	0.79	1.02	0.25	0.56	2.36	2.57
burned	1.23	5.44	2.77	5.32	2.51	0.61	5.34	3.91	1.28
flooded	—	—	1.43	5.87	0.18	—	—	—	—
plowed	—	—	—	—	0.09	—	—	—	—
burned + flooded	—	—	—	—	—	—	9.63	—	0.78
plowed + flooded	—	—	—	20.40	—	0.55	1.25	—	—
Wheat									
stubble	13.61	—	—	—	—	—	—	—	—
planted	—	—	—	—	51.36	33.36	13.09	—	11.56
Corn (plowed)	—	—	2.03	6.97	—	10.31	—	—	3.19
Plowed (bare)	1.42	—	—	0.03	—	—	—	—	—
Grassland	—	—	0.78	0.21	0.04	2.54	1.49	3.83	1.85
Alfalfa	0.80	0.22	—	—	—	—	—	—	—
No. cranes	643	312	523	596	630	1596	896	852	1157

[a]Percent use/percent availability.

planted winter wheat and disked corn stubble) were used sporadically in localized areas, waste rice was consumed consistently from October through February. Alteration of stubble, however, commonly reduced the quantity of rice available to cranes. Disking shortly after harvest was highly detrimental, and as a consequence birds generally shunned plowed fields. Burning of rice stubble usually resulted in intensive short-term use, but burned fields regularly attracted large numbers of geese, ducks, and blackbirds that rapidly depleted the food. Furthermore, Miller et al. (1989) found that burned stubble contains on average 276 kg/ha of waste rice, 30% less than the 388 kg/ha in unburned fields. Cranes were also attracted to rice stubble as it was being flooded but generally avoided fields once waste grains were inundated. Thus cranes, unlike geese and ducks, appear highly inefficient at locating submerged seeds.

Cranes foraged heavily in winter wheat at times. Harvested fields were used briefly in late October, but once wheat planting commenced use of stubble generally ceased. Cranes fed on new wheat from planting until shortly after emergence; once seedlings grew to about 5 cm use decreased. Hoffman (1976) noted a similar response in Michigan, with cranes usually avoiding fields when seedlings reach heights of 5–10 cm. Disked corn stubble also attracted cranes at times, but corn was limited on the study area. Disked corn was preferred, and no cranes were noted in standing stubble, but most fields had been plowed before surveys were initiated in late October. In contrast, in Indiana Lovvorn and Kirkpatrick (1982) found that cranes avoid plowed corn stubble in autumn, preferring instead stubble that had not been altered. Except for rice, wheat, and corn, cranes rarely used other crops in the upper Butte basin but did frequent cattle-grazed grasslands

Table 6 Weekly Habitat-Preference Indices[a] for Sandhill Cranes along a 77-km Transect through the Upper Butte Basin, 25 December 1992–15 February 1993

Habitat	25 Dec	31 Dec	7 Jan	14 Jan	21 Jan	28 Jan	3 Feb	8 Feb	15 Feb
Rice stubble									
unaltered	1.61	3.09	2.34	5.13	3.77	5.37	5.00	2.31	3.15
burned	0.21	2.13	0.84	0.61	0.64	0.03	0.61	-	0.04
flooded	—	—	—	—	0.59	—	—	—	—
plowed	—	—	—	0.08	—	—	0.15	1.16	0.18
Wheat (planted)	12.01	1.09	12.41	—	—	—	—	—	0.27
Corn (plowed)	15.05	—	—	0.18	—	—	3.46	2.64	18.86
Plowed (bare)	—	—	—	0.14	—	—	—	—	—
Grassland	1.26	3.46	2.61	0.53	3.58	0.91	0.10	1.62	—
Alfalfa	—	—	0.92	—	—	—	—	6.46	—
Fallow	0.01	—	—	0.94	—	—	—	0.14	0.16
No. cranes	859	457	579	1438	507	860	1136	687	948

[a]Percent use/percent availability.

during and after periods of rain. These grasslands were perhaps an important source for macroinvertebrates, providing essential proteins, calcium, and other nutrients generally not found in grains (Reinecke and Krapu 1986).

Sandhill Cranes have had a long history in the upper Butte basin, with the earliest account dating to 1828 (McGowan 1961), but historical crane foraging habitats were not documented. Perhaps acorns were an important pre-agriculture food; acorns have been reported in the diets of Sandhill Cranes elsewhere (Walkinshaw 1953, Guthery 1972). Substantial forests of Valley Oak once bordered most northern California rivers and sinks, and until 1849 these forests were virtually unaltered by people (Thompson 1980). Only scattered remnants of these once extensive woodlands currently persist. Before extensive European settlement, luxuriant grasses and forbs reportedly covered much of the upper Butte basin (Anderson 1992). Thus, before the 1850s, a mosaic of riparian systems, oak woodlands, grasses, and forbs likely created a diversity of high-quality habitat. By the 1860s, however, much of the original vegetation had been replaced with wheat, with rice introduced in 1912 (Willson 1979). Therefore, except during occasional droughts or floods, food has perhaps never been a limiting factor for cranes wintering in the upper Butte basin. However, changes in land use (e. g., conversion from grain crops to orchards and vineyards, and increased autumn disking, flooding, and burning of rice stubble) have eliminated or degraded the cranes' foraging habitat and will continue to do so. These changes, plus the spiraling costs of rice production and termination of government subsides to producers of rice and other grains, may result in food shortages for the cranes in the near future, at least in some portions of California's Central Valley.

ACKNOWLEDGMENTS

I thank the numerous California Department of Fish and Game personnel who were involved in the study. Special thanks to Paul Hofmann for his advice, logistic support, and study coordination, while Ron Rogers was responsible for the early phases, background information, and study design. Ron Bertram also provided advice and information. Bruce Deuel, Ron Schlorff, and Jim Snowden deserve special credit for their invaluable sharing of knowledge, field work, and advice. The staff at Gray Lodge Wildlife Area provided housing, data, and support, and to them I am most grateful, particularly to R. B. Reno and Mike Womack. I also express my appreciation to Bruce Deuel, Rod Drewien, Paul Hofmann, Gary Ivey, Tim Manolis, and Ron Schlorff for improving drafts of the manuscript, and to Caroline Herziger for word processing. The study was funded by the California Department of Fish and Game, Region 2, Rancho Cordova.

LITERATURE CITED

Anderson, R. 1992. The settlement of northern California. Dogtown Territorial Quarterly 12:10–11, 36–41, 52–54.

Drewien, R. C., and Bizeau, E. G. 1974. Status and distribution of Greater Sandhill Cranes in the Rocky Mountains. J. Wildlife Mgmt. 38:720–742.

Drewien, R. C., and Lewis, J. C. 1987. Status and distribution of cranes in North America, in Proc. 1983 Int. Crane Workshop (G. W. Archibald and R. F. Pasquier, eds.), pp. 469–477. Int. Crane Found., Baraboo, WI.

Guthery, F. S. 1972. Food habits, habitat, distribution and subspecies of Sandhill Cranes wintering in southern Texas. M. S. thesis, Tex. A & M Univ., College Station.

Heitmeyer, M. E., Connally, D. P., and Pederson, R. L. 1989. The Central, Imperial, and Coachella valleys of California, in Habitat Management for Migrating and Wintering Waterfowl in North America (L. M. Smith, R. L. Pederson, and R. M. Kaminski, eds.), pp. 475–506. Texas Tech Univ. Press, Lubbock.

Hoffman, R. H. 1976. Field usage by Sandhill Cranes in southern Michigan, in Proc. Int. Crane Workshop (J. C. Lewis, ed.), pp. 35–43. Okla. State Univ. Publ., Stillwater.

Littlefield, C. D. 1993. Greater Sandhill Crane assessment in the Upper Butte Basin, California 1991–1993. Report to Calif. Dept. Fish & Game, 1701 Nimbus Rd., Suite A, Rancho Cordova, CA 95670.

Littlefield, C. D., and Thompson, S. P. 1979. Distribution and status of the Central Valley population of Greater Sandhill Cranes, in Proc. 1978 Crane Workshop (J. C. Lewis, ed.), pp. 113–120. Colo. State Univ. Printing Serv., Fort Collins.

Littlefield, C. D., and Thompson, S. P. 1981. The Pacific Coast population of Lesser Sandhill Cranes in the contiguous United States, in Proc. 1981 Crane Workshop (J. C. Lewis, ed.), pp. 288–294. Natl. Audubon Soc., Tavernier, FL.

Lovvorn, J. R., and Kirkpatrick, C. M. 1982. Field use by staging eastern Greater Sandhill Cranes. J. Wildlife Mgmt. 46:99–108.

Madsen, C. R. 1967. Food and habitat selection by fall migrant Sandhill Cranes in Kidder County, North Dakota. M. S. thesis, Mich. State Univ., East Lansing.

McGowan, J. A. 1961. History of the Sacramento Valley, vol. 1. Lewis Hist. Publ., New York.

Miller, M. R., Sharpe, D. E., and Gilmer, D. S. 1989. Rice available to waterfowl in harvested fields in the Sacramento Valley, California. Calif. Fish and Game 72:113–123.

Montgomery, J. B. 1997. Sandhill Crane use of the mid-Pecos Valley of eastern New Mexico. Proc. N. Am. Crane Workshop 7:157–164.

Pogson, T. H. 1990. Distribution, abundance, and behavior of Greater Sandhill Cranes, *Grus canadensis tabida*, wintering in California's Central Valley. M. S. thesis. Univ. of Alaska, Fairbanks.

Pogson, T. H., and S. M. Lindstedt. 1991. Distribution and abundance of large Sandhill Cranes, *Grus canadensis*, wintering in California's Central Valley. Condor 91:266–278.

Reinecke, K. J., and Krapu, G. L. 1986. Feeding ecology of Sandhill Cranes during migration in Nebraska. J. Wildlife Mgmt. 50:71–79.

Thompson, K. 1980. Riparian forests of the Sacramento Valley, California, in Riparian Forest of California (A. Sands, ed.), pp. 35–38. Div. Agric. Sci., Univ. Calif., Davis.

Walkinshaw, L. H. 1953. Notes on the Greater Sandhill Crane (*Grus canadensis tabida*). Auk 70:204.

Walkinshaw, L. H. 1973. Cranes of the World. Winchester Press, New York.

Willson, J. H., ed. 1979. Rice in California. Butte Co. Rice Growers Assoc., Richvale, CA.

Accepted 10 December 2001

BOOK REVIEWS

Birds of the Lahontan Valley: A Guide to Nevada's Wetland Oasis, by Graham Chisholm and Larry A. Neel. 2001. University of Nevada Press. 256 pages, 60 illustrations, 5 maps. Paperback, $21.95. ISBN 0-87417-479-1.

When most people think of Nevada, they imagine either glittering casinos or vast tracts of dry landscape covered with sagebrush. Some western birders might have visions of small, damp patches of green in the gray-and-brown desert, with lost songbirds appearing and disappearing in those migrant traps. Few, however, would realize that 78,000 shorebirds were counted in Nevada's Lahontan Valley in the fall of 1998 or that 6500 White-faced Ibis nested there in 1997. Readers of this book will learn not just these tantalizing tidbits but also a wealth of information about the birds and, to a lesser extent, the geography, geology, botany, and history of one of Nevada's great wetlands.

Birds of the Lahontan Valley has three chapters plus two appendices. The first chapter describes the natural and human history of the valley. The second chapter is the heart of the book and comprises species accounts of birds recorded in the valley. Chapter three provides a brief look at some of the best birding locations in the area. Appendix 1 shows wader and shorebird census data for 1989 through 1999, and appendix 2 lists Christmas Bird Count data for 1985 through 1999.

The introduction states, "the purpose of this book is to bring together the wealth of information that exists on the bird life of the Lahontan Valley." It further asserts that "the species accounts ... build on Ray Alcorn's work ... to provide the first comprehensive review of the Lahontan Valley's avian life. The book provides detailed status, habitat, and seasonal occurrence information for the 297 bird species recorded in the valley." Chisholm and Neel bring strong credentials to these tasks. Chisholm has been a dominant figure in water-rights issues in Nevada for the past decade. He is currently executive director of the Nature Conservancy of California. Neel, staff nongame biologist for the Nevada Division of Wildlife (NDOW), plays an important role in shaping policy for that agency.

The first chapter of this book acquaints the reader with the history, geography, geology, and botany of the valley. Although brief, it provides enough information to satisfy the reader who is looking for an overview—and that is clearly what is intended. You don't have to read very far before you realize that the overriding issue in the Great Basin, as in much of the West, is water. Water issues pervade the entire history of the region.

Of course, chapter one only sets the stage for the main act, the species accounts. For this chapter, the authors researched the older literature, records from *Audubon Field Notes* and *American Birds*, museum specimens, records of the relatively new Nevada Bird Records Committee (NBRC), and the repositories of NDOW and Stillwater National Wildlife Refuge. The authors explain their criteria for records to be included in the text and, for the most part, they appear to follow those criteria. There are a few lapses, though. For example, I'm not sure why the report of 200 Baird's Sandpipers at Stillwater is included, and even the authors state that it is "unlikely." Most records, however, appear to have been carefully selected.

Each species account begins with common name, scientific name, and status. (A few of the scientific names are not quite current, as, for example, the Mountain Chickadee in the genus *Parus*.) The book provides arrival and departure times for migrants (often including documented earliest/latest dates.) Nesting status is described if applicable, as are habitat preferences for many species. For birds that are very localized within the valley, more specific location information is provided. Population status and changes are described for some species and, for introduced birds, the date of first introduction is included when available. Many accounts are complemented by wonderful black-and-

white drawings by Mimi Hoppe Wolf. (The cover art by Keith Hansen unfortunately seems to have suffered weak color reproduction in the copy I received.)

The accounts are written in a somewhat conversational style. This makes for pleasant reading but is less successful at providing the sightings in a format conducive to future research. Most of the records include the source, which might be a named individual, an issue of *American Birds* or *Audubon Field Notes*, Alcorn's *Birds of Nevada*, various government publications, the NBRC, or some other reference. Some also specify that there is a specimen or photo. However, many records of seemingly equal importance are not attributed to any source. Consider, for example, this report for the Blue Jay. "Alcorn (1988) reported 2 seen (1 collected) 2.4 miles west of Fallon on December 14, 1976 ... In addition, there is a sight record of a wintering Blue Jay in Fernley during the 1987–88 winter." One has to wonder why the latter sight record is not attributed to any source.

Often an account ends with thoughts like "the status of this species needs investigation." Perhaps the greatest strength of this book is its ability to provide the available information while also conveying the need for more study, more birders, more reports. For example, the account for the Black-and-white Warbler lists only one record but states that "this species is probably more common in the valley than the single record indicates"—two Black-and-white Warblers have been recorded in the Lahontan Valley since the book went to press.

Birders visiting the Lahontan Valley should use this book to help them decide which of their sightings should be documented and forwarded to the appropriate person or organization. Unfortunately the book does not specify where records should be sent. Check the website of the NBRC (www.gbbo.org/nbrc.htm), which also includes a link to Nevada's recently published review list. For species not on the review list, but which this book show to be unusual for the Lahontan Valley, submit your sightings to the address shown at www.gbbo.org/submit.htm. These reports will be considered for inclusion in *North American Birds*. Yet another place for reports and discussion of sightings (and other Nevada birding information) is the Nevada list server: see birdingonthe.net/mailinglists/NVBD.html.

The final chapter of the book contains descriptions of several of the best birding sites in the valley. While birders visiting the area will certainly find this section useful, most of these descriptions are quite brief. This is not necessarily a shortcoming of the book. One should purchase this book for the species accounts—the site guide is just a nice little bonus.

If you bird the Great Basin, or are contemplating doing so in the future, you should own *Birds of the Lahontan Valley*. Well-written, informative, and authoritative, it is a book you will consult time and again as you explore the area's surprising wetlands.

Martin Meyers

The Birds of Yakima County, Washington, by Andrew Stepniewski. 1999. Yakima Valley Audubon Society, Yakima, WA. 278 pages, 28 black-and-white drawings, 5 maps. Paperback, $21.95. ISBN 0-9674378-0-6.

Containing most of what you might wish to find, this 8½ × 11-inch volume could stand as the paradigm for county bird books. The author moved to Yakima County in 1978 and brought a professional attitude to bear in tracking down its bird life. Since then, he has systematically sought birds in all corners of the county, greatly expanding what was already a substantial knowledge base for a single county. The region treated extends from high elevations at Mount Adams and the Cascade Crest down to the valleys of the Yakima and Columbia rivers, thus encompassing a great variety of habitats and, accordingly, bird life. The species list for the county is not far behind those of King and Whatcom counties, both with county books published and both with coastlines.

The author's primary goal was "to elucidate each of the 302 species' status and distribution in this area and, just as important, its occurrence in a regional context." He has succeeded admirably in his first goal, and indeed the regional context is indicated for many species.

The book contains so much information that the Table of Contents could fill the space available for this review, and the amount of additional material is indicated by the individual species accounts—the "meat" of the book—occupying only half of its pages. There are maps of the county showing physiography, vegetation zones, public lands, and birdwatching sites. There are descriptions of each major habitat type, along with lists of birds characteristic of them and—something I found delightful—a full-page drawing of each habitat by Debra Davis with tiny birds *in situ*. Put together, those drawings would make an educational poster. The black-and-white drawings of individual birds make up in charm and habitat depiction what many of them lack in ornithological accuracy.

The introduction goes on to include a history of ornithology in Yakima County, a brief account of bird seasons, and a bar-graph chart of phenologies. There is also a fairly extensive guide to bird finding in the county, mostly organized around the relatively few lengthy roads. The main part of the text treats the species recorded from the county at that time, varying from a brief discussion of a single record for rare species to a full page for species of special interest, such as the Spotted Owl and Spruce Grouse, or very well-known species, such as the Red-tailed Hawk and Horned Lark. The status of each species is summarized at the beginning of the account. The level of detail presented is sufficient to include interesting aspects of distribution as a consequence of the county's range in elevation and habitats. For example, through his extensive field work, the author has discovered a surprising amount of movement by woodpeckers and corvids normally considered resident.

The lengthier accounts are full of interesting natural-history information, in fact, a tremendous amount of it, as well as being thorough summaries of the occurrence of the species in Yakima County. The accounts of the common species should be required reading for those interested in the natural history of Washington birds. Note the length of the *Empidonax* and sparrow accounts, which might convince one that the author has a particular love for dull-colored passerines.

As if the text summaries weren't enough, the author goes on to include a whole series of appendix tables. One summarizes distribution, habitat preference, and seasonality of each species, all in a single very handy format that could become the standard for bird lists handed out in wildlife refuges and nature centers. There follow tables showing the results of two Breeding Bird Surveys and two Christmas Bird Counts from the county. The Yakima Valley CBC has been carried out for sufficient time that it could be used as an indicator of bird population changes in the county. Finally, the results of a 1998 May big day, with nine teams participating, indicate the great diversity of breeding birds in the county.

I discovered no significant errors when reading the introductory material and many of the species accounts. Stepniewski has done his homework very well, ferreting out—and compiling in a very readable summary—specimen records, publications, and unpublished records from the many birders who have visited this interesting county.

What more might one ask for in a county bird book? I recently visited Monterey County, California, and used Don Roberson's *Monterey Birds*, published in 1985. That book has several features not present in the Yakima County book: (1) seasonal bar graphs associated with each species account as well as in a separate table, (2) specific birding routes, with mileages and more explicit directions, (3) range maps for all species known to breed in the county, (4) numerous photos documenting county rarities, (5) a small series of color photos of habitats and both common and rare birds, and (6) small size (dimensions much smaller, weight about half). Of these differences, 1, 2, 3, and 6 all make the Monterey book of greater use in the field. However, the Yakima book contains considerably more information and in addition is more fun to read. It should be considered a reference for the bookshelf rather than the car seat.

If you live in anywhere in Washington state, you should have *The Birds of Yakima County* as a significant reference. If you live anywhere else in the world, acquire a copy just to own a superb example of this kind of book.

Dennis R. Paulson

FEATURED PHOTO

TREE-NESTING CLIFF SWALLOWS IN THE SAN BERNARDINO MOUNTAINS, CALIFORNIA

KIMBALL L. GARRETT, Section of Vertebrates, Natural History Museum of Los Angeles County, 900 Exposition Blvd., Los Angeles, California 90007.

The widespread Cliff Swallow (*Petrochelidon pyrrhonota*) attaches its retort-shaped mud nests to cliffs, cave entrances, and a variety of artificial substrates, but the use of tree trunks and limbs for nest attachment has rarely been reported (Brown and Brown 1995). Nevertheless, Cliff Swallow colonies on yellow pines (*Pinus ponderosa* and/or *P. jeffreyi*) were long ago documented in the Big Bear Lake area of the San Bernardino Mountains, California, by Grinnell (1908; photographs), Willett (1912), and Dawson (1923; photographs). These authors did not specify the exact location(s) of the tree colonies within the Big Bear Valley; Dawson (1923) attributed the use of tree substrates to the lack of other suitable substrates in an "otherwise delectable country."

I photographed a group of Cliff Swallow nests on a ponderosa pine (*Pinus ponderosa*) in October 1981 along Shay Road near the southwestern corner of Baldwin Lake in Big Bear Valley, San Bernardino Mountains (34° 16′ N, 116° 49′ W; see back cover); the nests were constructed and occupied the previous summer. This colony was active throughout the 1970s and early 1980s, often being a focal point of Audubon chapter birding trips to the San Bernardino Mountains; my field notes contain references to this colony for the years 1977 through 1983. Ongoing residential development has altered the landscape of this portion of the Big Bear Valley, and the nesting colony was no longer extant as of 1992 (Herbert Clarke pers. comm). In June 1989 James E. Pike (pers. comm.) observed at least one other small colony in pine trees just east of Holcomb Valley Campground, 10 km northwest of the Baldwin Lake site.

On 13 June 1980 I recorded detailed information about the placement of nests in the pine tree colony at Baldwin Lake. I counted a minimum of 154 nests on 18 trees. I was able to examine the entire trunks of only five trees, so many additional nests were probably hidden from view on the back sides of trunks of the remaining trees. Nest height (estimated visually) on these mature (30–35 m) pines ranged from 7 to 17 m (mean 11.0 m; $n = 44$). Nest placement by quadrant (based on the 44 nests on the five trees examined in their entirety) was 10 in the north quadrant (i.e., quadrant centered on 0° compass reading), 13 in the east quadrant, 15 in the south quadrant, and 6 in the west quadrant. This slight but nonsignificant tendency toward a southeasterly orientation (Kruskal–Wallis test of means; $p = 0.412$) agrees with Grinnell's (1937) description of a colony in Berkeley, California. Of the 154 nests observed, 148 were placed underneath a limb or stub (although some stubs were very small, i.e., <10 cm), one was placed laterally beside a small stub, and only five were placed directly on the trunk away from any limb or stub. Six clusters (totaling 15 nests) consisted of two to three extensively conjoined nests; many of the other 139 nests adjoined their neighbor(s) at the base. In 1981 (when the back-cover photo was taken), nests appeared to be more closely clustered; Brown and Brown (1995) noted that Cliff Swallows "prefer nests that share walls with neighbors." During the summer of 1980 I noted several other colonies of Cliff Swallows in the Big Bear Valley on buildings, dams, and other artificial substrates; one of those was along Shay Road within 1 km of the tree colony.

Cliff Swallows' use of trees as nest substrates is clearly a rare event and is not documented elsewhere in the species' broad North American range (Brown and

Brown 1995, C. R. Brown pers. comm.). There is no mention of tree nesting in Colorado, where the species is widespread in ponderosa pine habitat (Kingery 1998). Similarly, no published breeding bird atlases from California counties mention trees as nest substrates. The unique colonies in the Big Bear Valley first documented by Grinnell, Dawson, and Willett now seem to have fallen victim to suburban sprawl and resort development, perhaps through a combination of reduction of overall habitat suitability for Cliff Swallows (Breeding Bird Survey data suggest recent population declines in southern California; Brown and Brown 1995) and the provision of a wealth of artificial structures for alternative nest placement.

I thank Herbert Clarke, Jim Pike, and Doug Willick for providing additional information about the Big Bear Valley colonies, and Kathy Molina and Charles R. Brown for comments on a draft of this note.

LITERATURE CITED

Brown, C. R., and Brown, M. B. 1995. Cliff Swallow (*Hirundo pyrrhonota*), in The Birds of North America (A. Poole and F. Gill, eds.), no. 149 Acad. Nat. Sci., Philadelphia.

Dawson, W. L. 1923. The Birds of California, vol. 2. South Moulton Co., San Diego.

Grinnell, J. 1908. The biota of the San Bernardino Mountains. Univ. Calif. Publ. Zool. 5 (1):1–170.

Grinnell, J. 1937. The swallows at the Life Sciences building. Condor 39:206–210.

Kingery, H. E., ed. 1998. Colorado Breeding Bird Atlas. Colo. Wildlife Heritage Foundation, Denver.

Willett, G. 1912. Birds of the Pacific slope of southern California. Pac. Coast Avifauna 7.

27th Annual Meeting of the Western Field Ornithologists

10–13 October 2002

The San Joaquin Wildlife Sanctuary in Irvine and Ayres Country Inn in Costa Mesa, California

Conference Information

Orange County, California, offers wonderful opportunities for birders to discover southern California resident and migrant bird species in rural, urban, suburban, and pelagic settings. The area is rich in bird life, and October will find WFO visiting during autumn migration. Bolsa Chica, Newport Back Bay, Limestone Canyon, Dripping Springs, the "gold coast," the Pacific Ocean, Starr Ranch, and urban parrot roosts are examples of the field trips that have been planned for this meeting to highlight the rich diversity of landscape zones and birds that Orange County has to offer. With sufficient interest, postmeeting trips will go to the Salton Sea and Baja California.

Activities

WFO 2002 offers a mix of half-day field trips on October 11, 12, and 13. Other planned activities include a workshop on documenting bird records, evening field trips, a banding trip for hawks or owls, a full-day pelagic trip, afternoon paper sessions, and identification panels using both slides and recorded sounds. Social activities will include a welcoming reception, barbecue at the San Joaquin Wildlife Sanctuary, the annual dinner, and evening programs.

Speakers

The featured speakers for WFO 2002 are renowned marine biologist Robert L. Pitman and our own Philip Unitt. Bob will speak on the eastern Pacific pelagic frontier at the annual dinner to be held on Saturday, October 12. Phil will speak on the surprises revealed by the five years of field work for the San Diego County bird atlas at the barbecue on Friday, October 11.

Meeting Sponsors

WFO 2002 is locally hosted and sponsored by Sea and Sage Audubon Society and co-sponsored by Los Angles Audubon Society. A number of local organizations are lending their support for this meeting.

Hotel Information

Headquarters for all conference activities will be Ayres Country Inn and Suites, 325 Bristol Street, Costa Mesa, California 92626. This is a world-class small hotel that is well located with easy airport or freeway access. Ask for Western Field Ornithologists when booking your reservations: 714-549-0300, 800-322-9992. Consider bringing the entire family. There are two pools and, for the enjoyment of nonbirding family members, free transportation to nearby sights and activities. The hotel has set aside a block of 50 double rooms for WFO at $69.00 per night for a 3-night minimum stay, if the room is booked prior to September 15, 2002. The hotel is located 5 minutes from the Orange County/John Wayne Airport and will provide free transportation from the airport for hotel guests. The conference schedule, costs, and registration forms are posted at www.wfo-cbrc.org and www.seaandsageaudubon.org.

For additional information contact robcatwaters@earthlink.net.

WESTERN BIRDS

World Wide Web site: www.wfo-cbrc.org

Quarterly Journal of Western Field Ornithologists

President: Mike San Miguel, 2132 Highland Oaks Dr., Arcadia, CA 91006; sanmigbird@aol.com

Vice-President: Daniel D. Gibson, University of Alaska Museum, 907 Yukon Dr., Fairbanks, AK 99775-6960

Treasurer/Membership Secretary: Robbie Fischer, 1359 Solano Drive, Pacifica, CA 94044; robbie22@pacbell.net

Recording Secretary: Kei Sochi, The Nature Conservancy, Western Regional Office, 2060 Broadway, Suite 230, Boulder, CO 80302; ksochi@tnc.org

Directors: Ted Floyd, Kimball L. Garrett, Daniel D. Gibson, Bob Gill, Gjon Hazard, Dave Krueper, Mike San Miguel, W. David Shuford, David Yee

Editor: Philip Unitt, San Diego Natural History Museum, P. O. Box 121390, San Diego, CA 92112-1390; birds@sdnhm.org

Associate Editors: Daniel D. Gibson, Robert A. Hamilton, Ronald R. LeValley, Tim Manolis, Kathy Molina, Mark K. Sogge

Graphics Manager: Virginia P. Johnson, 4637 Del Mar Ave., San Diego, CA 92107

Photo Editor: Peter La Tourrette, 1019 Loma Prieta Ct., Los Altos, CA 92024

Featured Photo: Robert A. Hamiltom, 34 Rivo Alto Canal, Long Beach, CA 90803

Book Reviews: Steve N. G. Howell, Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach, CA 94970

Secretary, California Bird Records Committee: Guy McCaskie, P. O. Box 275, Imperial Beach, CA 91933-0275; guymcc@pacbell.net

Chairman, California Bird Records Committee: Richard A. Erickson, LSA Associates, 1 Park Plaza, Suite 500, Irvine, CA 92614; richard.erickson@lsa-assoc.com

Membership dues, for individuals and institutions, including subscription to Western Birds: Patron, $1000.00; Life, $400 (payable in four equal annual installments); Supporting, $60 annually; Contributing, $34 annually; Family $26; Regular U.S. $22 for one year, $41 for two years, $60 for three years. Dues and contributions are tax-deductible to the extent allowed by law.

Send membership dues, changes of address, correspondence regarding missing issues, and orders for back issues and special publications to the Treasurer. Make checks payable to Western Field Ornithologists.

Back issues of Western Birds within U.S. $24 per volume, $6.00 for single issues, plus $1.00 for postage. Outside the U.S. $30 per volume, $7.50 for single issues.

The California Bird Records Committee of Western Field Ornithologists revised its 10-column Field List of California Birds in January 2000. The last list covered 606 accepted species; the new list covers 613 species. Please send orders to WFO, c/o Robbie Fischer, Treasurer, 1359 Solano Drive, Pacifica, CA 94044. California addresses please add 7.75% sales tax.

Quantity: 1–9, $1.50 each, includes shipping and handling; 10–39, $1.30 each, add $2.00 for shipping and handling; 40 or more, $1.15 each, add $4.00 for shipping and handling.

Published May 31, 2002 ISSN 0045-3897

NEW...SWAROVSKI 65 MM SPOTTING SCOPES

BIG SCOPE PERFORMANCE...JUST SMALLER AND LIGHTER.

ATS 65 scope compared to an ***average 77 or 85 MM scope size***

The new ATS and STS 65 MM spotting scopes deliver the performance you normally expect from a competitive 77 or 85 MM spotting scope, but in a much smaller and lighter package (12" long and just over 2 lbs.). It even has a close focus of 10 feet, and a 33% wider field of view than the larger scopes with similar, 20-60 zoom eyepieces.

The new 65 MM scopes even compare favorably with the weight and size of popular 60MM scopes that only have zoom eyepieces to 45X. The Swarovski scope delivers much better optical and ergonomic performance. You get all of these new features at a surprisingly affordable price, when you consider the premium quality of the Swarovski 65MM ATS 65/ATS 65 HD and STS 65/STS 65 HD Spotting Scopes.

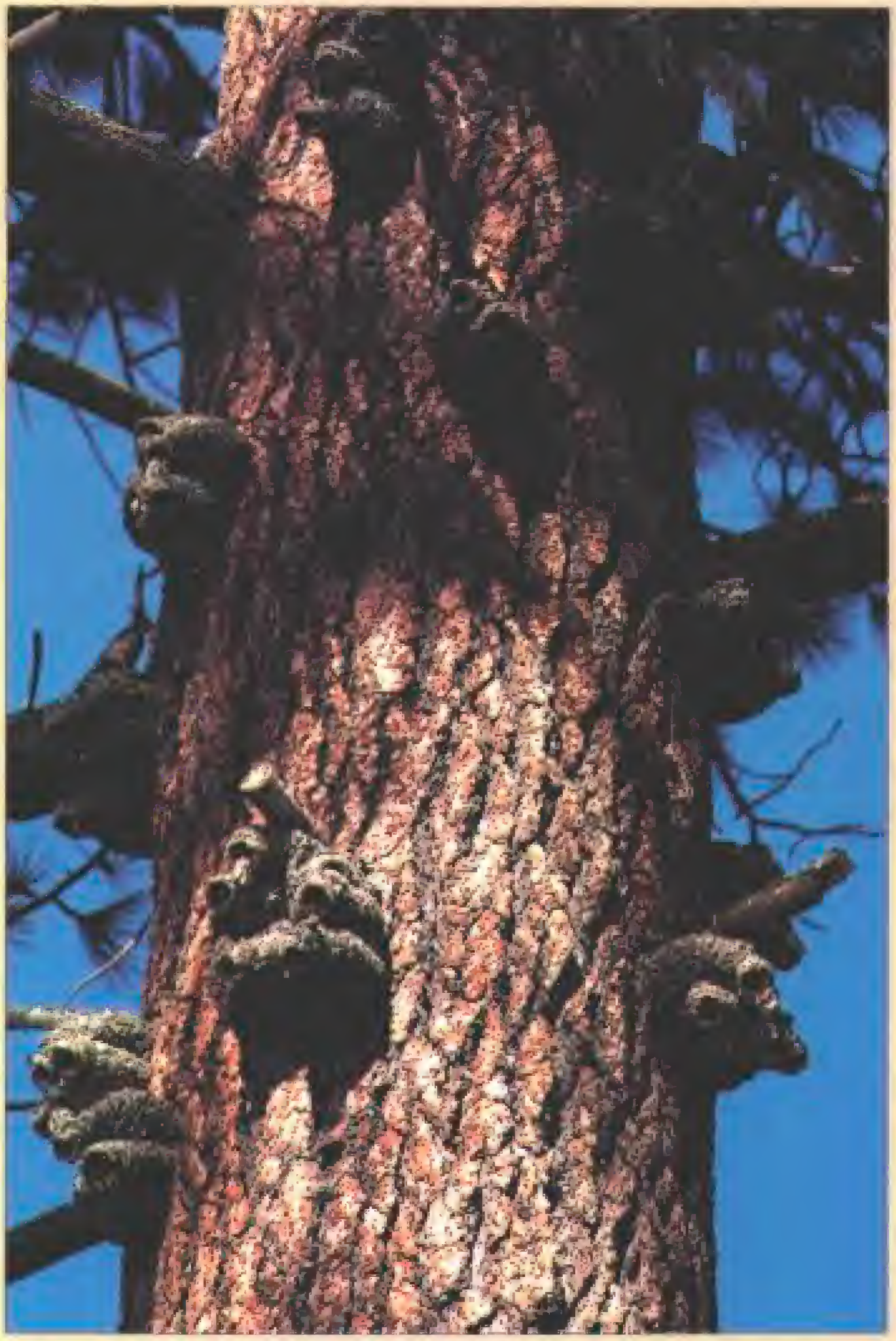
For more information call: 800-426-3089, e-mail: info@swarovskioptik.com or visit: www.swarovskioptik.com.

SWAROVSKI

OPTIK

WITH THE EYES OF A HAWK

Swarovski Optik North America, Ltd., 2 Slater Road, Cranston, RI 02920



SWAROVSKI
OPTIK
A Proud Sponsor of Western Field Ornithologists

WESTERN BIRDS

Vol. 33, No. 2, 2002

Volume 33, Number 2, 2002

Abundance and Distribution of Shorebirds in the San Francisco Bay Area *Lynne E. Stenzel, Catherine M. Hickey, Janet E. Kjelmyr, and Gary W. Page* 69

Historical and Present Breeding Season Distribution of Steller's Eiders in Alaska *Lori T. Quakenbush, Robert H. Day, Betty A. Anderson, Frank A. Pitelka, and Brian J. McCaffery* 99

NOTES

First Record of A Greater Shearwater in Alaska *John M. Pearce* . . 121

Gnatcatcher Sympatry Near San Felipe, Baja California, With Notes on Other Species *Robert A. Hamilton and Steve N. G. Howell* 123

Book Review *Ted Floyd* 125

Featured Photo *Robert A. Hamilton and John L. Dunn* 128

Cover photo by © Bruce Hallett of Atlanta, Georgia: Eurasian Bullfinch (*Pyrrhula pyrrhula*), Gambell, St. Lawrence Island, Alaska, June 2001.

Western Birds solicits papers that are both useful to and understandable by amateur field ornithologists and also contribute significantly to scientific literature. The journal welcomes contributions from both professionals and amateurs. Appropriate topics include distribution, migration, status, identification, geographic variation, conservation, behavior, ecology, population dynamics, habitat requirements, the effects of pollution, and techniques for censusing, sound recording, and photographing birds in the field. Papers of general interest will be considered regardless of their geographic origin, but particularly desired are reports of studies done in or bearing on the Rocky Mountain and Pacific states and provinces, including Alaska and Hawaii, awestern Texas, northwestern Mexico, and the northeastern Pacific Ocean.

Send manuscripts to Kathy Molina, Section of Ornithology, Natural History Museum of Los Angeles County, 900 Exposition Blvd., Los Angeles, CA 90007. For matter of style consult the Suggestions to *Contributors to Western Birds* (8 pages available at no cost from the editor) and the *Council of Biology Editors Style Manual* (available for $24 from the Council of Biology Editors, Inc., 9650 Rockville Pike, Bethesda, MD 20814).

Reprints can be ordered at author's expense from the Editor when proof is returned or earlier.

Good photographs of rare and unusual birds, unaccompanied by an article but with caption including species, date, locality and other pertinent information, are wanted for publication in Western Birds. Submit photos and captions to Photo Editor. Also needed are black and white pen and ink drawings of western birds. Please send these, with captions, to Graphics Manager.

WESTERN BIRDS

Volume 33, Number 2, 2002

ABUNDANCE AND DISTRIBUTION OF SHOREBIRDS IN THE SAN FRANCISCO BAY AREA

LYNNE E. STENZEL, CATHERINE M. HICKEY, JANET E. KJELMYR, and GARY W. PAGE, Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach, California 94970

ABSTRACT: On 13 comprehensive censuses of the San Francisco–San Pablo Bay estuary and associated wetlands we counted 325,000–396,000 shorebirds (Charadrii) from mid-August to mid-September (fall) and in November (early winter), 225,000 from late January to February (late winter); and 589,000–932,000 in late April (spring). Twenty-three of the 38 species occurred on all fall, early winter, and spring counts. Median counts in one or more seasons exceeded 10,000 for 10 of the 23 species, were 1,000–10,000 for 4 of the species, and were less than 1,000 for 9 of the species. On rising tides, while tidal flats were exposed, those flats held the majority of individuals of 12 species groups (encompassing 19 species); salt ponds usually held the majority of 5 species groups (encompassing 7 species); 1 species was primarily on tidal flats and in other wetland types. Most species groups tended to concentrate in greater proportion, relative to the extent of tidal flat, either in the geographic center of the estuary or in the southern regions of the bay. Shorebirds' densities varied among 14 divisions of the unvegetated tidal flats. Most species groups occurred consistently in higher densities in some areas than in others; however, most tidal flats held relatively high densities for at least one species group in at least one season. Areas supporting the highest total shorebird densities were also the ones supporting highest total shorebird biomass, another measure of overall shorebird use. Tidal flats distinguished most frequently by high densities or biomass were on the east side of central San Francisco Bay and adjacent to the active salt ponds on the east and south shores of south San Francisco Bay and along the Napa River, which flows into San Pablo Bay. The bay is critical to large numbers of wintering, migrating, and breeding shorebirds, despite extensive loss of natural wetlands. Geographic limitations of species' distributions in the bay should be considered when wetland restoration is planned.

The San Francisco–San Pablo Bay estuary and associated wetlands (hereafter, the bay) are of hemispheric importance (Harrington and Perry 1995) to wintering and migrating shorebirds. On the conterminous U. S. Pacific coast, the bay holds more total shorebirds than any other wetland in all seasons, and it holds the majority of individuals of the 13 most abundant

shorebirds in one or more seasons (Page et al. 1999). While a variety of natural and artificial habitats support shorebirds in the bay, more detailed patterns of habitat use are known only generally for all shorebirds and locally for a few species.

In 1964 and 1965, Bollman et al. (1970) conducted a large-scale but not comprehensive census of water birds in the bay, documenting sizable populations and general distribution patterns. Otherwise, past studies of shorebirds using the bay have focused primarily on seasonal abundance patterns, species composition at individual sites (Storer 1951, Recher 1966, Holway 1990), or occurrence in specific nontidal habitats (Anderson 1970, Swarth et al. 1982, R. Pratt unpubl. data). While studies of shorebirds' habitat use in the bay have addressed the Marbled Godwit, Willet, and Western Sandpiper (Luther 1968, Kelly and Cogswell 1979, Warnock and Takekawa 1995), there has been no overall assessment of the relative role of different habitat types or areas in supporting shorebirds. Detailed knowledge of habitat use is critical for recognizing the importance of different parts of the bay to shorebirds, for maintaining the integrity of habitat systems used by individual birds, and for maximizing the quality of wetlands created, restored, or managed in the bay. It is also important to understanding the sources and significance of environmental contaminants found in shorebirds, especially in urbanized environments such as San Francisco Bay (Ohlendorf and Fleming 1988).

In this paper we report the abundance and spatial distribution of the bay's most common shorebirds and compare their densities by 14 divisions of the tidal flat.

STUDY AREA

Our study area was the intertidal portion of the San Francisco–San Pablo Bay estuary and associated nontidal wetlands (Figure 1). Habitats covered during surveys included intertidal (flats, sloughs, and marshes), actively managed salt ponds, and "other" wetlands (sewage and other water-treatment ponds, salt ponds in disuse, and a wide variety of diked wetlands). Prior to the first census, we reconnoitered the bay's shore, salt ponds, and other wetlands extensively. From these visits we outlined and described census areas and devised protocols for coverage intended to minimize undetected flock movements that would introduce count errors (Stenzel and Page 1988). Prior to subsequent censuses we made a reconnaissance for the availability of salt ponds and other wetlands to keep our census-site descriptions current with changes in habitat conditions and accessibility.

We divided the bay into four major regions: San Pablo Bay (SPB) between the Carquinez Bridge and points San Pedro and San Pablo, North San Francisco Bay (SFN) between points San Pedro and San Pablo and the San Francisco–Oakland Bay Bridge, Central San Francisco Bay (SFC) between the San Francisco–Oakland Bay and San Mateo bridges, and South San Francisco Bay (SFS) south of the San Mateo Bridge (Figure 1). SFN and SFC combined were called Central San Francisco Bay by Stenzel and Page (1988) and the Goals Project (1999). We further subdivided the intertidal flats of the four regions into 14 tracts (Figure 1).

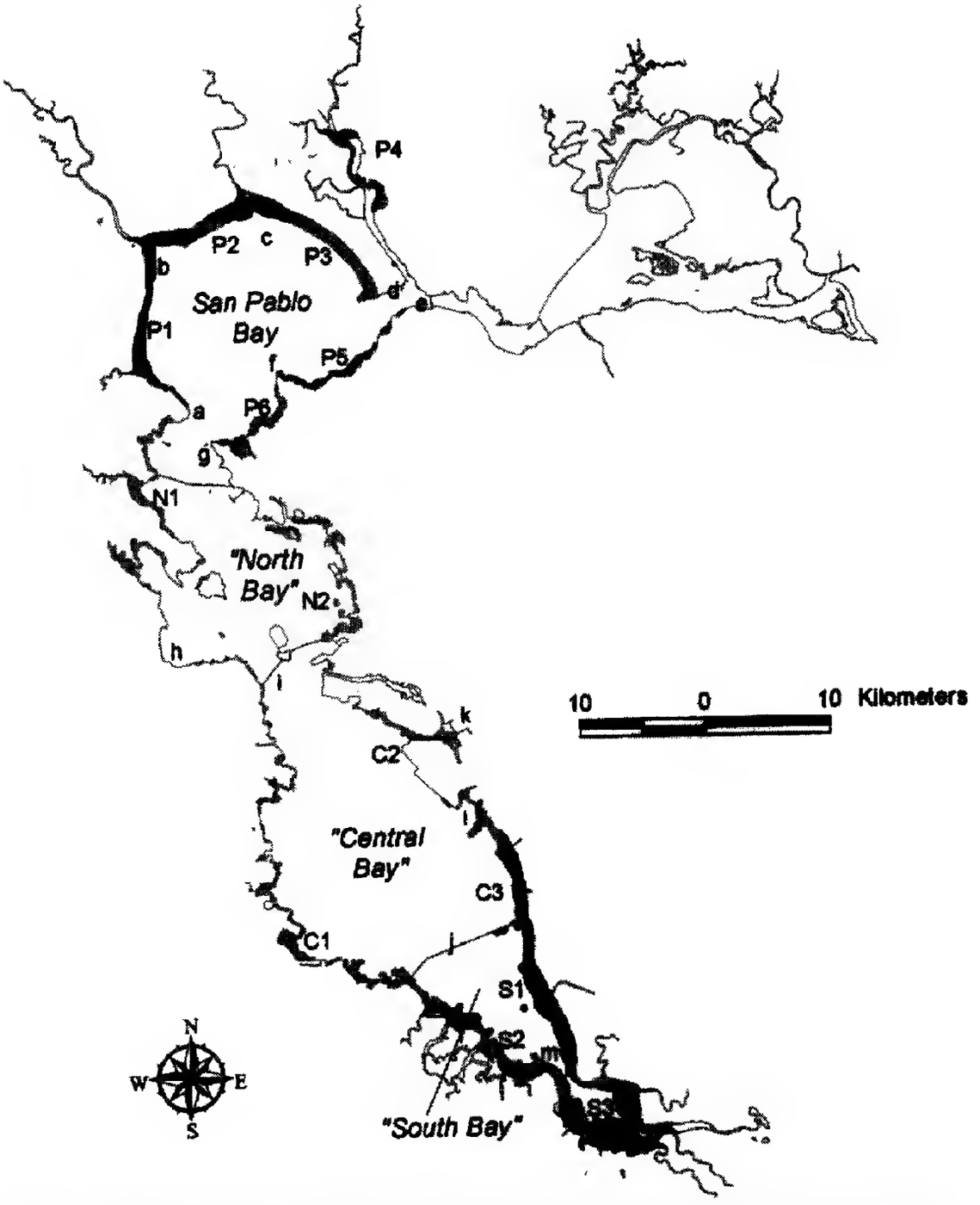


Figure 1. San Francisco–San Pablo Bay estuary, showing San Pablo Bay and three regions of San Francisco Bay. Tidal tracts in San Pablo Bay Region comprise P1, the west shore between Point San Pedro (reference point a) and the Petaluma River mouth (b); P2, the northwest shore between point b and Sonoma Creek (c); P3, the northeast shore between point c and the Napa River mouth (d); P4, Napa River flats north of point d; P5, the east shore between the Carquinez Bridge (e) and Point Pinole (f); and the southeast shore between point f and Point San Pablo (g). Tidal tracts in north San Francisco Bay comprise N1, the west shore between point a and the Golden Gate (h); and N2, the east shore between point g and the Bay Bridge (i). Tidal tracts in central San Francisco Bay comprise C1, the west shore between i and the Hayward–San Mateo Bridge (j); C2, San Leandro Bay (k) and the south shore of Alameda; C3, Hayward shoreline between Bay Farm Island (l) and j. Tidal tracts in south San Francisco Bay include S1, the west shore between j and the Dumbarton Bridge (m); S2, the east shore between j and m; and S3, the shore south of m. Base map from the EcoAtlas, version 1.5003, July 1998, San Francisco Estuary Institute.

The western and northern shores of San Pablo Bay are surrounded by extensive agricultural and undeveloped diked baylands, the largest expanses of tidal marsh in the bay, and actively managed salt-evaporation ponds. The eastern shore of SPB is partially developed for residences and industry. San Pablo Bay itself is relatively shallow; a broad swath of tidal flat rims the west and north shores, and about half the bay is under less than 2 m of water at low tide. SPB comprises six tidal tracts (Figure 1), which together were 34–36% of the total tidal flat surveyed on our three fall and five spring counts.

North San Francisco Bay is distinguished by a heavily urbanized shoreline, with most of the rocky intertidal and bluff-backed shore in the bay, and a small amount of supralittoral wetland habitat. SFN is mostly deep water with relatively little tidal flat, which we allocated into two tidal tracts (Figure 1). Only 8–9% of the total tidal flat surveyed on our three fall and five spring counts was in SFN.

The western shoreline of central San Francisco Bay is developed mostly for industry but the eastern side is a mixture of developed and undeveloped uplands and restored wetlands. A wide swath of tidal and shallow subtidal flat dominates the southeast shore, but tidal flat is patchy elsewhere in this region (Figure 1). SFC comprises three tidal tracts (Figure 1), which combined were 14–16% of the tidal flat surveyed on our three fall and five spring counts.

South San Francisco Bay is rimmed by a large system of managed and disused salt ponds, with residentially developed shoreline limited to the northwest portion of the region. Tidal and shallow subtidal flats lie outside the outer levees of the salt ponds. SFS comprises three tidal tracts (Figure 1), together making up 41–44% of the tidal flat surveyed on our three fall and five spring counts.

There were approximately 11,400 ha of tidal flats above 0.0 mean lower low water (MLLW) and 14,000 ha of actively managed salt ponds in the bay during our study. We covered 83–91% of the tidal flat on the surveys. North of San Pablo Bay were 2890 ha of salt ponds; reconnaissance trips revealed few shorebirds and little shallow habitat, so we covered only 7.2–13% of the salt ponds in this area. At the south end of the bay there were 11,100 ha of salt ponds, of which we covered 26–87% on the surveys.

METHODS

We conducted 13 censuses between April 1988 and April 1993 to estimate total numbers of shorebirds in the bay. We made three fall counts between mid-August and mid-September, 1988–1990, three "early winter" counts in early November 1990–1992, a late winter count in late January to early February 1991, and six spring counts in late April 1988–1993. Censusers included Point Reyes Bird Observatory (PRBO) staff biologists, other trained biologists, and volunteers recruited from local Audubon societies. We offered training sessions, attended by over 100 participants, on methods of identifying and counting shorebirds.

We counted birds on moderately high rising tides (starting censuses at approximately +0.3 m MLLW at the Golden Gate Bridge), covering SPB

and SFN on one day of a weekend, SFC and SFS on the other. We divided the shoreline into segments that could be surveyed in 1 to 2 hrs by a single census team (there were usually three to six census segments per tidal tract). All habitat within the shoreline segments was surveyed, including flat, slough, riprap, and marsh. To avoid counting the same flocks twice, we surveyed wetlands and salt ponds before birds counted on the tidal flats moved into the ponds at high tide. Census teams comprised one to six people with binoculars and, at minimum, a 20× spotting telescope; each team included one or more observers experienced at identifying and counting shorebirds. When necessary, census team leaders met after the counts and discussed bird movement to reduce the likelihood that individual flocks of birds were counted by more than one census team. Approximately 100 counters took part in the censuses each day. In April 1993, extensive dredging along outer levees in parts of SFS prevented us from reaching some large shoreline census segments; where possible we made our best estimates of the birds in these areas from nearby segments. Also on that census, because of a shortage of experienced observers for San Pablo Bay, we conducted an aerial survey of the western and northern shores and used ground censuses from the same day in those areas to refine our estimates of species composition. We use the 1993 spring count only in our presentation of shorebird totals for the entire bay, acknowledging that the poorer coverage in SFS and the use of aerial censuses in San Pablo Bay may have biased the totals from this census (probably downward).

We conducted winter censuses at high-tide roosting areas (primarily salt ponds) under high spring tides. This was necessary because, after significant rain, we could not reach most of the shoreline of SFS. Counts within general regions of the bay were conducted simultaneously. We used fewer observers than on spring and fall counts and took 4–9 days to complete each winter count.

We instructed counters to identify to species all shorebirds except the Short and Long-billed dowitchers. When identification to species of most individuals in a flock was not feasible, observers estimated flock size, noted which species were included in those flocks, and estimated proportions of the different species. Methods of data collation for unidentified shorebirds are in Page et al. (1999). The percentage of total small *Calidris* sandpipers unidentified was 27% in fall, 24% in winter, and 11% in spring; of total yellowlegs 8% in fall, 4% in winter, and 11% in spring; of total phalaropes 8% in fall and 9% in spring. For intra-estuarine analyses, we combined into species groups (1) small *Calidris* sandpipers, including, the Western, Least, and Dunlin; (2) the Greater and Lesser Yellowlegs; (3) the Wilson's and Red-necked Phalaropes; and (4) rocky-coast species, including the Black Oystercatcher, Wandering Tattler, Ruddy Turnstone, Black Turnstone, and Surfbird.

We intended the study primarily to estimate the total number of shorebirds in the bay; examining the species' spatial distribution was a secondary objective. High annual return rates of individual shorebirds to their wintering grounds (Kelly and Cogswell 1979, Warnock et al. 1997) and the persistence of some individuals in the bay over a winter season (Kelly and Cogswell

1979, Evans and Pienkowski 1984, Warnock and Takekawa 1996) result in potentially high correlations between censuses. This inherent nonindependence of the data and the small sample sizes for each season limit the legitimacy and usefulness of significance tests and determined the exploratory approach to the data we use here.

We use medians to estimate abundance because the median is less sensitive than the mean to outlying values, but we also present means and coefficients of variation (corrected for small sample sizes) for comparisons of variability within fall and spring counts. We categorize each species' overall abundance by the season of the species' highest median abundance: abundant, >10,000; moderately abundant, 1000–10,000; common, <1000 and occurring on all fall, early winter, and spring counts; uncommon to rare, not occurring on all fall, early winter, and spring counts. Species' abundances from the single late winter census (February 1991) are reported as ratios of abundance from the previous early winter census (November 1990), giving an indication of whether that species' abundance increased or decreased between one early and late winter count.

We estimated densities (number per hectare) for total shorebirds and for species groups counted on the tidal flats on both fall and spring censuses. Fixed tidal areas for density calculations were derived from the EcoAtlas (beta version 1.5003, July 1998), a digital map of the bay generated by the San Francisco Estuary Institute. The lower extent of tidal flat in the EcoAtlas represents the mean lower low-water datum (0.0 MLLW). We calculated the intertidal area above 0.0 MLLW for each shoreline census segment. Although counters surveyed all tidal habitat within their shoreline segments, they rarely reported birds to be in tidal marshes, so we used only the area of tidal flats to generate densities. For each census, we summed the area and the shorebird totals for the segments that were covered (for each of the 14 tidal tracts and for the total tidal flat of the bay) to obtain estimates of density and biomass.

We used the maximum overall (total tidal flat) densities for each species group per season as benchmarks with which we compared densities by individual tidal tract. We identified two categories of important tidal tracts for each species group: frequent high use—densities exceeding the seasonal benchmark on more than one half of the censuses, and consistent high use—densities exceeding the seasonal benchmark on all censuses.

As an alternative perspective on densities of total shorebirds, we also estimated total shorebird biomass (kilograms per hectare) for each tidal tract covered on each census and for all tidal flats combined. Because the two to four most abundant species in an estuary on average may account for over 90% of the total (Page et al. 1999), these totals are often dominated by a few species. We used the masses from Dunning (1992) and Page et al. (1979) to calculate the biomass in each tidal tract for each census. Warnock and Bishop (1998) reported mean body masses for Western Sandpipers 23–29% higher after mid-April than in winter on San Francisco Bay. Because data reflecting the potentially greater body masses of shorebirds during migration periods were not available for all species, we limited our comparisons to among tidal tracts within the same season and not between seasons.

RESULTS

Overall Abundance

Shorebirds of 38 species totaled 340,000 to 396,000 individuals on fall surveys, 325,000 to 358,000 on early winter surveys, 225,000 on the late winter survey, and 589,000 to 932,000 on spring surveys. Although more species were at maximum abundances in fall and winter, two of the most abundant taxa (Western Sandpiper and dowitchers) reached peak numbers in spring, making spring the period of highest overall shorebird abundance. Twenty-three species, including the Short- and Long-billed dowitchers combined, occurred on all fall, early winter, and spring censuses (Table 1). All of the above species except the Red-necked Phalarope also occurred on the late winter census. The Western Sandpiper was the most abundant species on each census, exceeding 100,000 individuals on all but one census. Median numbers for this species exceeded 100,000 individuals in fall and winter and 500,000 in spring (Table 1). The Dunlin was the next most abundant species, with median numbers of over 100,000 individuals in winter and 75,000 in spring. Abundant species with median numbers of 10,000 to 100,000 individuals were the Marbled Godwit, Least Sandpiper, and dowitchers (every season), Black-bellied Plover, American Avocet, and Willet (fall and winter), and Red-necked Phalarope (fall). Moderately abundant species included the Semipalmated Plover, Black-necked Stilt, Long-billed Curlew, and Red Knot. Common species included the Snowy Plover, Killdeer, Greater Yellowlegs, Lesser Yellowlegs, Spotted Sandpiper, Whimbrel, Ruddy Turnstone, Black Turnstone, and Sanderling (Table 1).

Most occurrences of rare to uncommon species were during migration periods (Table 2), with the exception of the golden-plovers, Black Oystercatcher, Pectoral Sandpiper, and Common Snipe, recorded on the November "early winter" survey as well (still within the fall migration period for the Pectoral Sandpiper and snipe). The Semipalmated Sandpiper and Buff-breasted Sandpiper occurred only in fall, the Solitary Sandpiper occurred only in spring, and the Wandering Tattler, Surfbird, Baird's Sandpiper, and Ruff occurred on both fall and spring censuses. The Red Phalarope migrates, primarily over ocean waters, through November and occurred on one fall count and one early winter count. The single record for the Stilt Sandpiper was in early winter.

Some species were consistently more abundant in one or two seasons than the others (Table 1). The Black-necked Stilt, American Avocet, Willet, and Long-billed Curlew were more abundant in fall and winter than in spring. The Whimbrel, Western Sandpiper, and Least Sandpiper were more abundant in fall and spring than in winter; the Western Sandpiper was most abundant in spring, and the Least Sandpiper was most abundant in fall. The Spotted Sandpiper and Red-necked Phalarope were most abundant in fall; the Red-necked Phalarope was least abundant in winter. Dunlins do not normally arrive in central California in large numbers until after September and thus were more abundant on winter and spring counts than on fall counts. Dowitchers were most abundant in spring every year.

Table 1 Censuses of Common Shorebirds by Season in the San Francisco Bay Area

	Fall[a]			Early Winter[b]				Spring[c]		
Species	Median	Mean	CV[d]	Median	Mean	CV	Ratio[e]	Median	Mean	CV
Black-bellied Plover *Pluvialis squatarola*	12,165	12,619	10	13,246	12,596	14	1.00	4451	5706	62
Snowy Plover *Charadrius alexandrinus*	122	128	25	153	130	37	0.22	75	73	52
Semipalmated Plover *Charadrius semipalmatus*	2369	2106	25	924	981	65	0.87	1579	1745	57
Killdeer *Charadrius vociferus*	477	448	27	214	222	9	1.36	206	197	48
Black-necked Stilt *Himantopus mexicanus*	5589	6239	20	4975	5104	46	0.53	880	1088	78
American Avocet *Recurvirostra americana*	17,429	17,671	43	23,125	23,164	10	0.90	3879	4253	40
Greater Yellowlegs *Tringa melanoleuca*	439	465	35	323	320	6	0.23	327	407	54
Lesser Yellowlegs *Tringa flavipes*	68	58	50	26	37	71	0.14	56	51	76
Willet *Catoptrophorus semipalmatus*	24,056	23,045	9	16,971	17,864	21	0.96	3353	3121	55
Spotted Sandpiper *Actitis macularia*	43	45	32	8	11	64	1.43	17	17	39
Whimbrel *Numenius phaeopus*	133	188	69	71	70	10	0.92	124	123	25
Long-billed Curlew *Numenius americanus*	1956	1780	38	1474	1592	52	0.25	283	342	50
Marbled Godwit *Limosa fedoa*	24,673	24,216	22	16,812	16,430	5	0.79	20,312	19,984	45

Ruddy Turnstone *Arenaria interpres*	59	73	64	47	50	41	1.85	72	78	54
Black Turnstone *Arenaria melanocephala*	53	77	74	103	105	39	2.07	86	88	89
Red Knot *Calidris canutus*	1827	1698	29	507	790	130	2.50	761	854	72
Sanderling *Calidris alba*	825	1292	68	539	563	23	1.28	414	475	64
Western Sandpiper *Calidris mauri*	181,607	189,359	17	122,968	120,449	24	1.00	516,670	536,423	19
Least Sandpiper *Calidris minutilla*	48,294	49,465	18	14,475	12,099	47	0.30	23,812	24,314	34
Dunlin *Calidris alpina*	16	14	71	121,329	110,147	22	0.60	62,382	76,406	53
Dowitchers *Limnodromus* spp.[f]	23,805	22,666	10	18,130	19,160	16	0.65	43,638	45,040	24
Red-necked Phalarope *Phalaropus lobatus*	18,969	16,588	42	3	3	108	0.00	1785	2961	100

[a]Three censuses, mid-August–mid-September 1988–1990.

[b]Three censuses, early November 1990–1992.

[c]Six censuses, late April 1988–1993.

[d]CV, coefficient of variation.

[e]Ratio of results of a census in February 1991 to those in November 1990.

[f]*L. scolopaceus* and *L. griseus*.

Table 2 Frequency of Occurrence and Maximum Number of Rare and Uncommon Species on Shorebird Censuses of the San Francisco Bay Area

	Fall[a]		Early Winter[b]		Spring[c]	
Species	Freq.	Max.	Freq.	Max.	Freq.	Max.
Golden-plovers						
Pluvialis dominica/fulva	3	11	2	3	2	2
Black Oystercatcher						
Haematopus bachmani	2	4	1	2	4	4
Solitary Sandpiper						
Tringa solitaria	0	0	0	0	1	4
Wandering Tattler						
Heteroscelus incanus	3	16	0	0	5	7
Surfbird						
Aphriza virgata	3	17	0	0	4	77
Semipalmated Sandpiper						
Calidris pusilla	2	1	0	0	0	0
Baird's Sandpiper						
Calidris bairdii	3	20	0	0	2	2
Pectoral Sandpiper						
Calidris melanotos	2	12	1	1	2	3
Stilt Sandpiper						
Calidris himantopus	0	0	1	1	0	0
Buff-breasted Sandpiper						
Tryngites subruficollis	1	2	0	0	0	0
Ruff						
Philomachus pugnax	1	2	0	0	1	2
Common Snipe						
Gallinago gallinago	3	2	3	15	4	5
Wilson's Phalarope						
Phalaropus tricolor	3	1642	0	0	2	213
Red Phalarope						
Phalaropus fulicaria	1	15	1	22	0	0

[a]Three censuses, mid-August–mid-September 1988–1990.

[b]Three censuses, early November 1990–1992.

[c]Six censuses, late April 1988–1993.

Annual variability in abundance was lower in fall and winter, when the median coefficient of variation (CV) for species' totals was 30.5 each season, than in spring, when the median CV was 53.0 (Table 1). Variability among counts was low relative to other species in fall for the Black-bellied Plover and Willet, in winter for the Killdeer, American Avocet, Greater Yellowlegs, and Marbled Godwit, in spring for the Spotted Sandpiper, and in fall and spring for the Western Sandpiper, Least Sandpiper, and dowitchers (Table 1). Although variability in numbers was also relatively low in winter and spring for the Whimbrel, it was relatively high in fall for this species. The variability of abundant species was sometimes high at that species' season of minimal occurrence (e.g., Dunlin in fall, Red-necked Phalarope in winter). It

was high for species associated with rocky coasts, which we did not cover completely (e.g., Ruddy Turnstone in fall, Black Turnstone in fall and spring), for less abundant species (e.g., Lesser Yellowlegs and Spotted Sandpiper in winter), and for the Red Knot (Table 1).

Distribution by Habitat

Twelve of 18 species groups (see Methods) occurred mostly in tidal habitats, when these were exposed (surveyed only in fall and spring). For all 12 species groups, at least 60% of the individuals were in tidal habitat on all surveys (Figure 2).

Of other species, only phalaropes occurred predominantly in salt ponds on all surveys, but 50% or more of the Black-necked Stilts were in salt ponds on four of five spring censuses. Also, at least 35% of Snowy Plovers and American Avocets during fall and at least 40% of Snowy Plovers and yellowlegs during spring surveys were in salt ponds (Figure 2). We found a higher proportion of both stilts and avocets in salt ponds in fall than in spring (with one exception). In contrast to this pattern for stilts and avocets, we found a higher proportion of yellowlegs in salt ponds in spring than in fall.

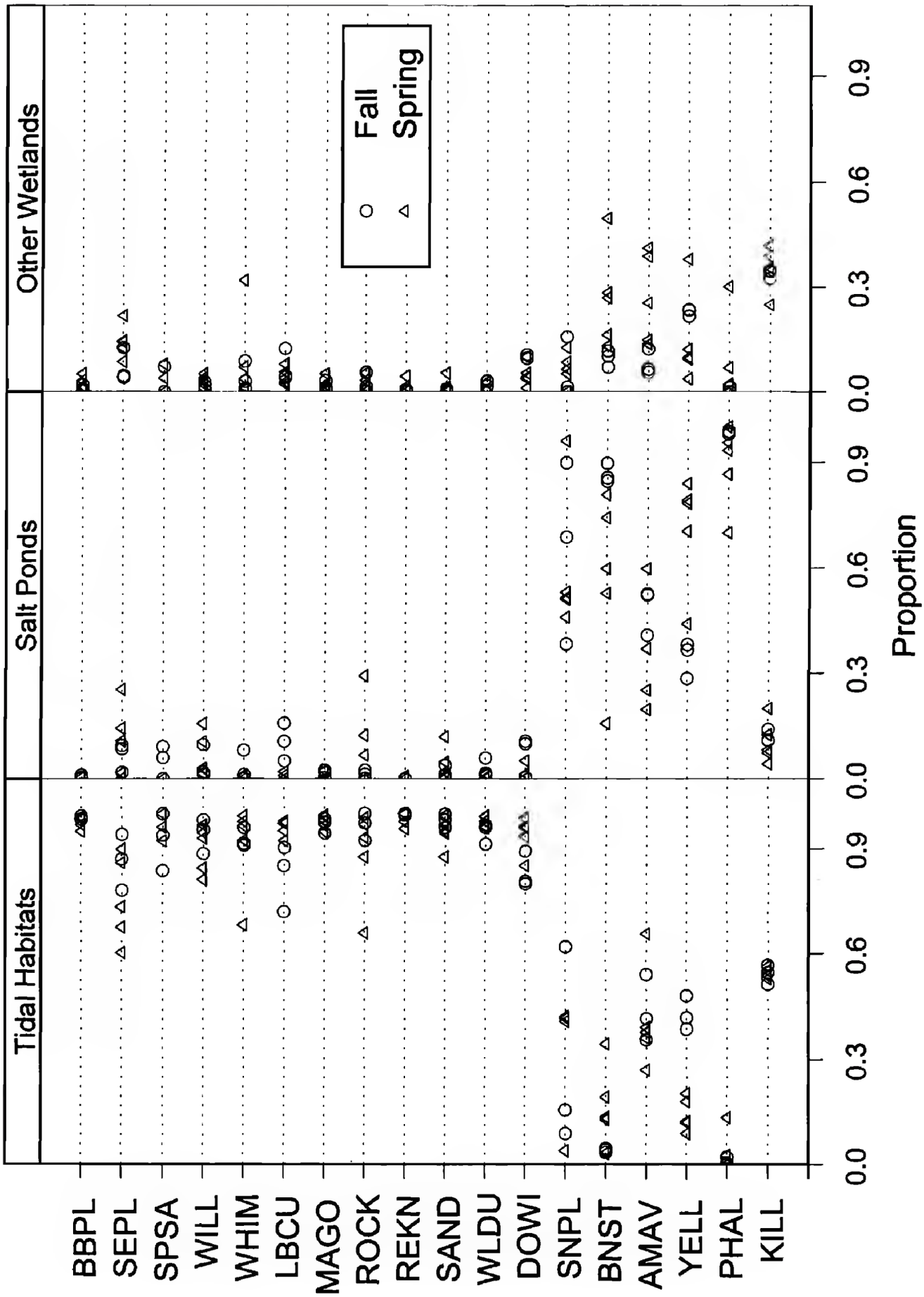
The Killdeer was the only shorebird for which at least 20% of the individuals were consistently in wetland habitats other than tidal flats or salt ponds.

Distribution by Region of the Bay

There were major differences in distribution among species groups over the four regions of the bay. The proportional distributions of the species-group totals relative to the proportional distribution of tidal flats fell mostly into one of two patterns: (1) occurring mostly in the north and central San Francisco Bay regions (SFN and SFC), or (2) occurring mostly in the central and south San Francisco Bay regions (SFC and SFS). Nevertheless, all regions of the bay supported high proportions of some species groups on some censuses.

Although the majority of tidal flat in the bay lies in San Pablo Bay (SPB) and SFS, high proportions of some species were found in SFN and SFC. This tendency was most pronounced for the Spotted Sandpiper in SFN, for the Semipalmated Plover, Red Knot, and dowitchers in SFC, and for the Killdeer, rocky-coast species, Whimbrel, and Sanderling in both regions (Figure 3). These species groups all have habitat distributions biased toward tidal flats, or tidal flats and other wetlands, when the tidal flat was exposed (Figure 2).

The tendency for a higher proportion of some species to occur in SFS, relative to the proportion of tidal flat, was very prominent for salt-pond specialists (Figure 2) but was also evident for some of the 12 tidal flat species. The proportions of the Snowy Plover, stilt, avocet, yellowlegs, and phalaropes in SFS almost always exceeded the proportion of tidal flat in the region, a result largely due to the numbers of these species groups counted in the salt ponds of SFS. Additionally, the proportion of the Black-bellied Plover and dowitchers always exceeded, and the proportion of the Willet and Marbled Godwit usually exceeded, the proportion of tidal flat habitat in SFS (Figure 3).


Tidal Habitats
Salt Ponds
Other Wetlands
Fall
Spring
BBPL
SEPL
SPSA
WILL
WHIM
LBCU
MAGO
ROCK
REKN
SAND
WLDU
DOWI
SNPL
BNST
AMAV
YELL
PHAL
KILL
0.0
0.3
0.6
0.9
Proportion

The proportion of most species in SPB tended to be smaller than the relative proportion of the tidal flat. The one exception, the Long-billed Curlew, occurred in this region in a proportion higher than that of tidal flat on all fall and most winter and spring counts (Figure 3).

In most regions of the bay, occurrence of the Red Knot was highly variable. On all but one fall and one winter census, knots concentrated in SFC. Proportions in SFS in fall and winter were also higher than expected. Although the proportion in SPB usually was less than that predicted by the extent of tidal flat, on one spring census over 80% of the knots were found in that region (Figure 3).

Shorebird Densities on Tidal Flats

Total shorebird biomass was 2.8–3.2 (median 2.9) kg/ha in fall and 2.5–4.3 (median 3.5) kg/ha in spring (with body masses not seasonally adjusted). Tidal tracts that supported the greatest biomass in fall were the Napa River flats (P4), San Leandro Bay (C2), and the east and south shores of central and south San Francisco Bay (C3, S2, S3; Figure 4). In spring the areas of highest biomass were noncontiguous segments of SFC and SFS: San Leandro Bay and the east shore of SFS (S2; Figure 5). The difference between the tidal tracts with the highest and lowest biomasses was largest in fall (Figure 6). In spring the biomass within tidal tracts was highly variable, and the estimates for tracts of high and low median biomass often overlapped broadly (Figure 6).

Densities of total shorebirds were greater in spring than in fall and were dominated by the abundance of small *Calidris* sandpipers at both seasons. In fall, total shorebird densities on all tidal flats combined, 29–34 (median 33) shorebirds/ha, were never as high as in spring, when they were 58–90 (median 72) shorebirds/ha. On individual tidal tracts, densities ranged from 2.5 to 89 (median 22) shorebirds/ha in fall and 4.1–270 (median 54) shorebirds/ha in spring.

Areas of consistent high use (with densities higher than benchmark on all censuses, see Methods) for *Calidris* sandpipers were the Napa River flats (P4), Hayward Shoreline (C3), and the south end of SFS (S3) in fall and the east shore of SFS (S2) in fall and spring (Figure 7). Tidal tracts getting frequent high use in spring, where small sandpipers exceeded season benchmark densities on at least half the spring censuses, were the west shore of SPB (P1) and the south end of SFS. We recorded densities of less

---

Figure 2. The proportion of bay totals for 18 shorebird species or species groups found in three wetland habitat types on three fall and five spring censuses. A proportion for each habitat type is displayed for each taxon for each census. BBPL, Black-bellied Plover; SEPL, Semipalmated Plover; SPSA, Spotted Sandpiper; WILL, Willet; WHIM, Whimbrel; LBCU, Long-billed Curlew; MAGO, Marbled Godwit; ROCK, Ruddy and Black turnstones, Black Oystercatcher, Wandering Tattler, and Surfbird; REKN, Red Knot; SAND, Sanderling; WLDU, Western and Least sandpipers and Dunlin (combined); DOWI, dowitcher spp.; SNPL, Snowy Plover; BNST, Black-necked Stilt; AMAV, American Avocet; YELL, yellowlegs; PHAL, phalaropes; KILL, Killdeer.

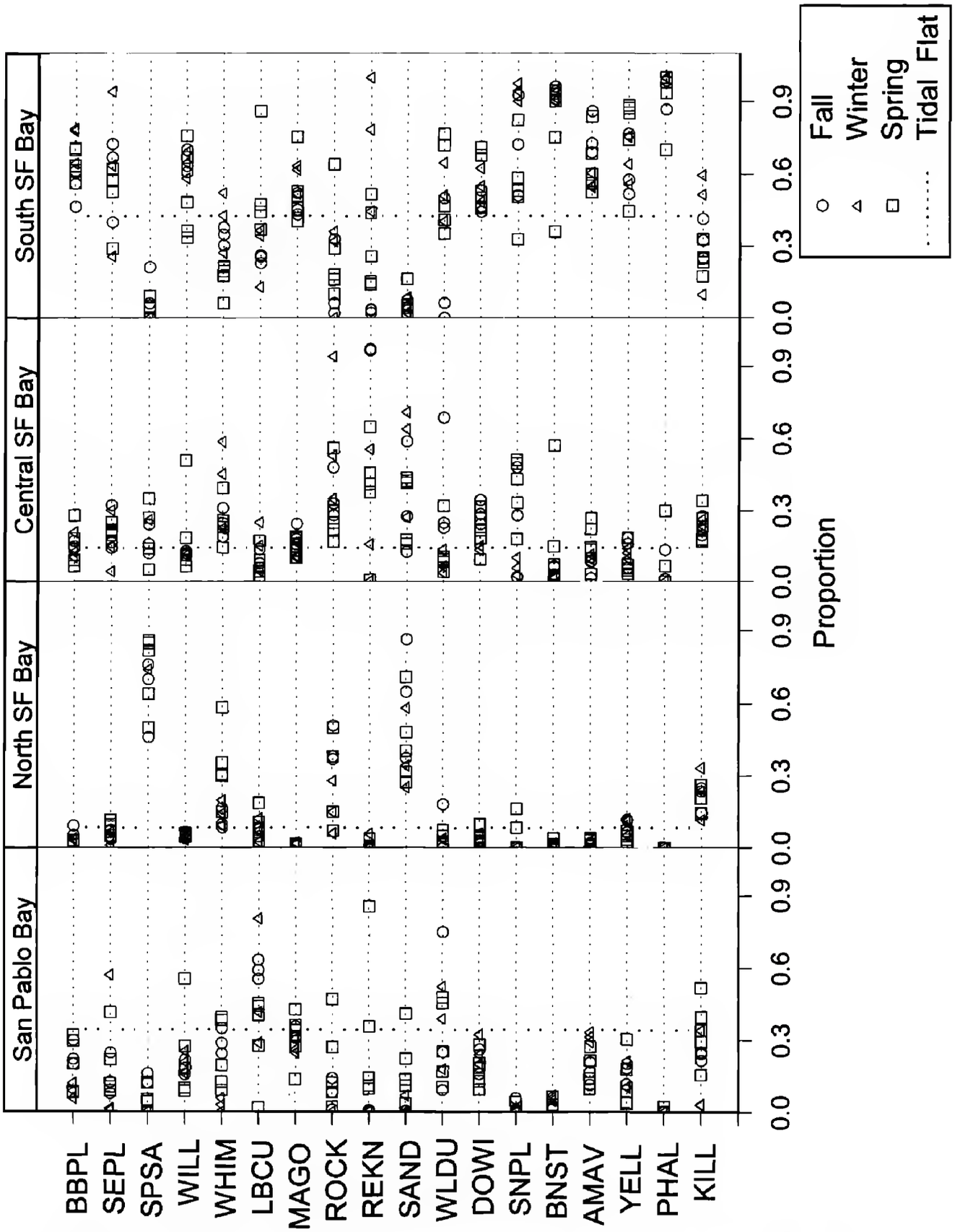


Figure 3. The proportion of the totals for 18 shorebird species or species groups that were found in four regions of the bay. Dotted vertical reference lines in each panel indicate the proportion of the total estuary tidal flat that was located in each of the four regions. Data from three fall, three early winter, and five spring censuses except when fewer than 10 individuals of that species were counted in the bay. For abbreviations, see Figure 2.

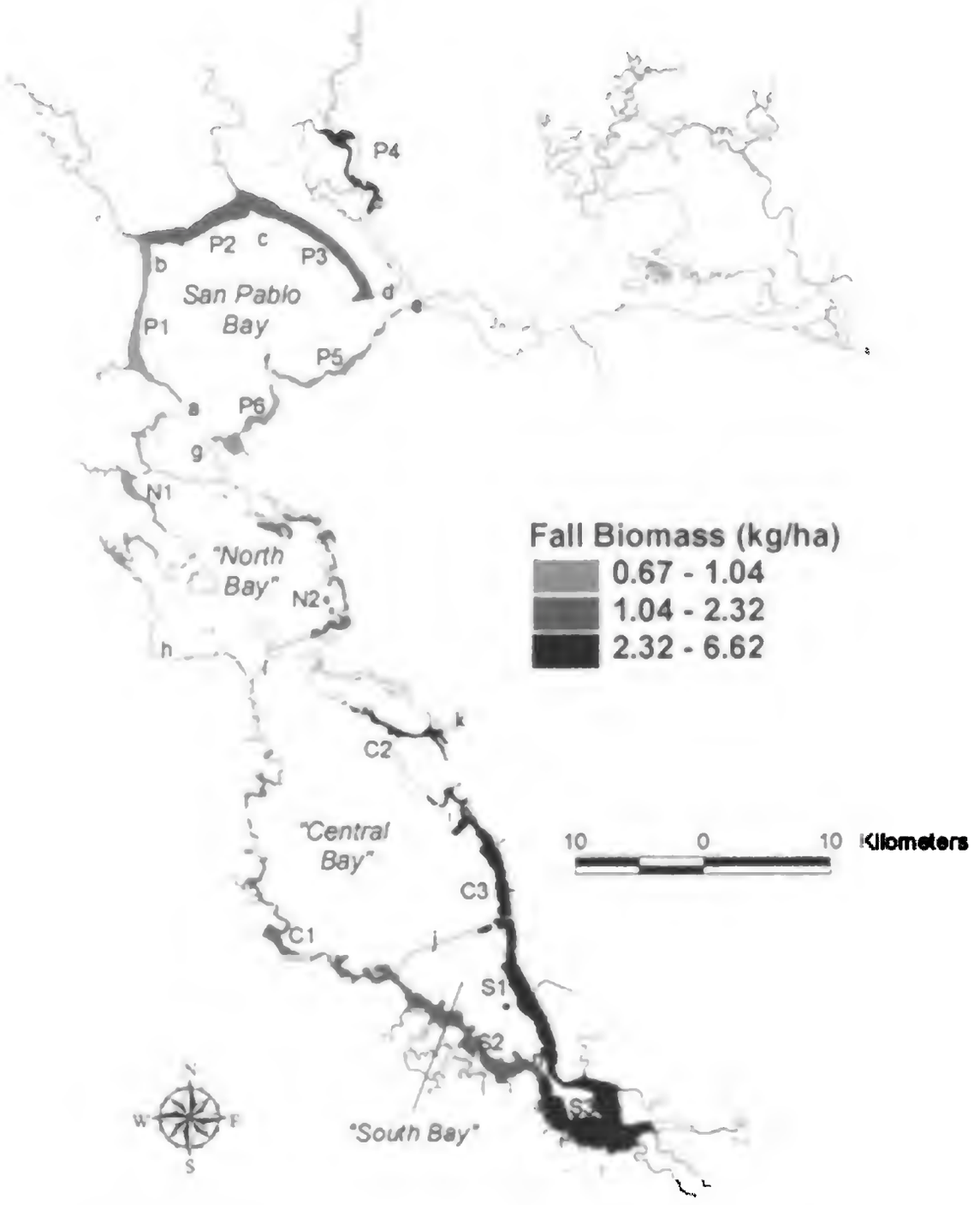


Figure 4. Median fall shorebird biomass on 14 tidal tracts (see Figure 1 for description of tracts). Base map from the EcoAtlas, version 1.5003, July 1998, San Francisco Estuary Institute.

than 50 sandpipers/ha in fall (except on the Napa River flats), and usually less than 150 sandpipers/ha in spring (Figure 7).

Among the species groups, dowitchers had the second highest densities. Among the tidal tracts, densities were consistently high on the Napa River (P4), the Hayward Shoreline (C3), and at the south end of SFS in fall and in San Leandro Bay (C2) in fall and spring (Figure 8). Tracts getting frequent high use by dowitchers were the southeast shore of SPB (P6), the west shore of SFC (C1), and the east shore of SFS (S2) in spring. Densities were usually

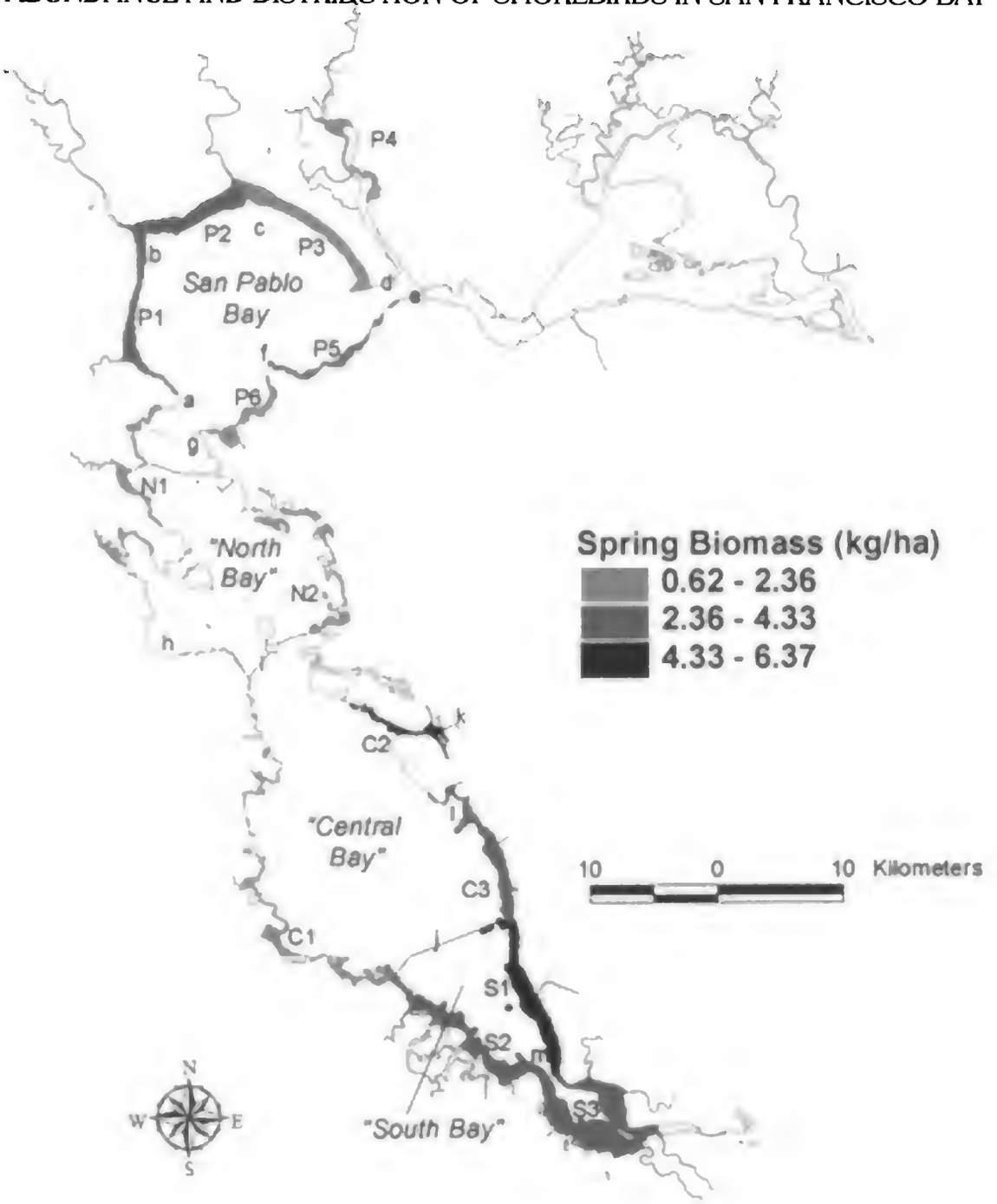
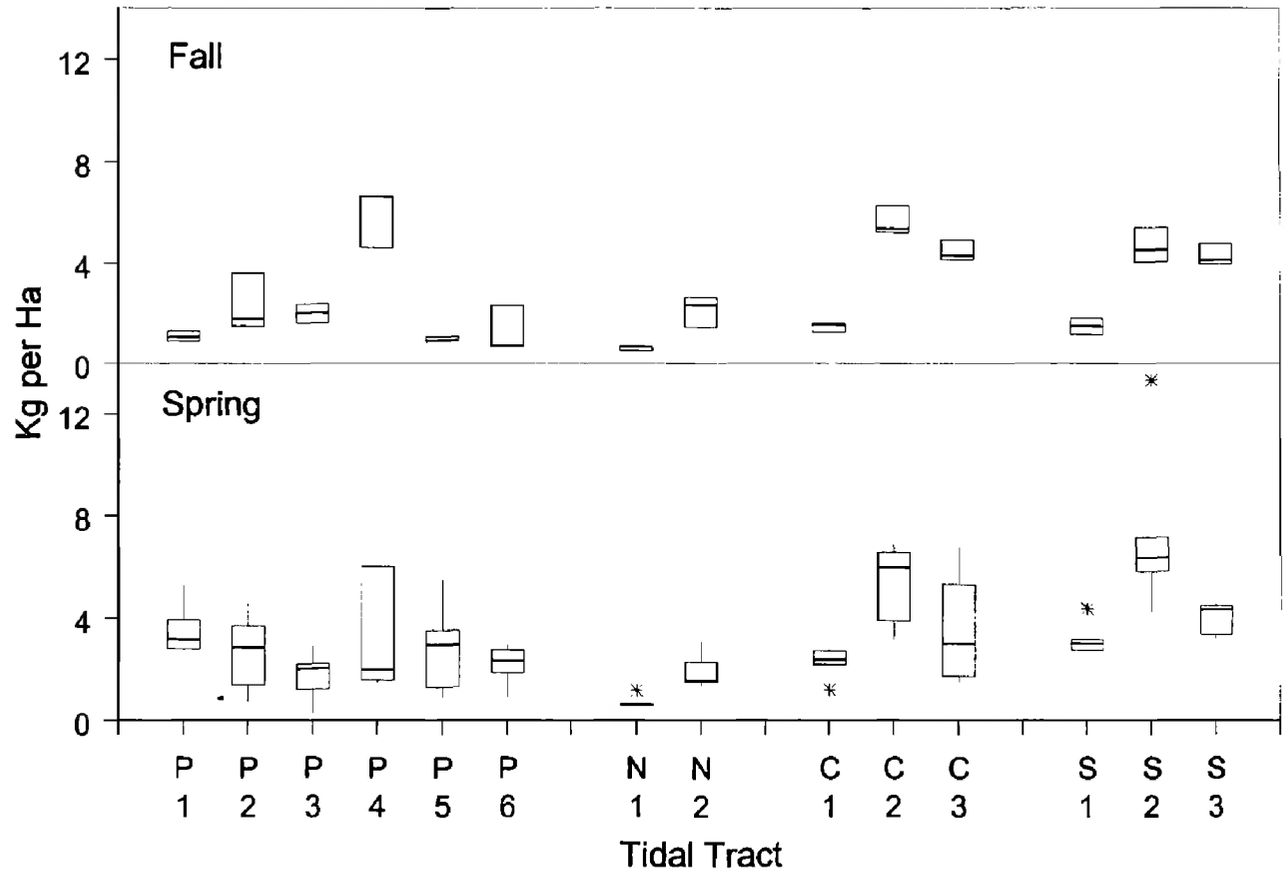


Figure 5. Median spring shorebird biomass on 14 tidal tracts (see Figure 1 for description of tracts). Base map from the EcoAtlas, version 1.5003, July 1998, San Francisco Estuary Institute.

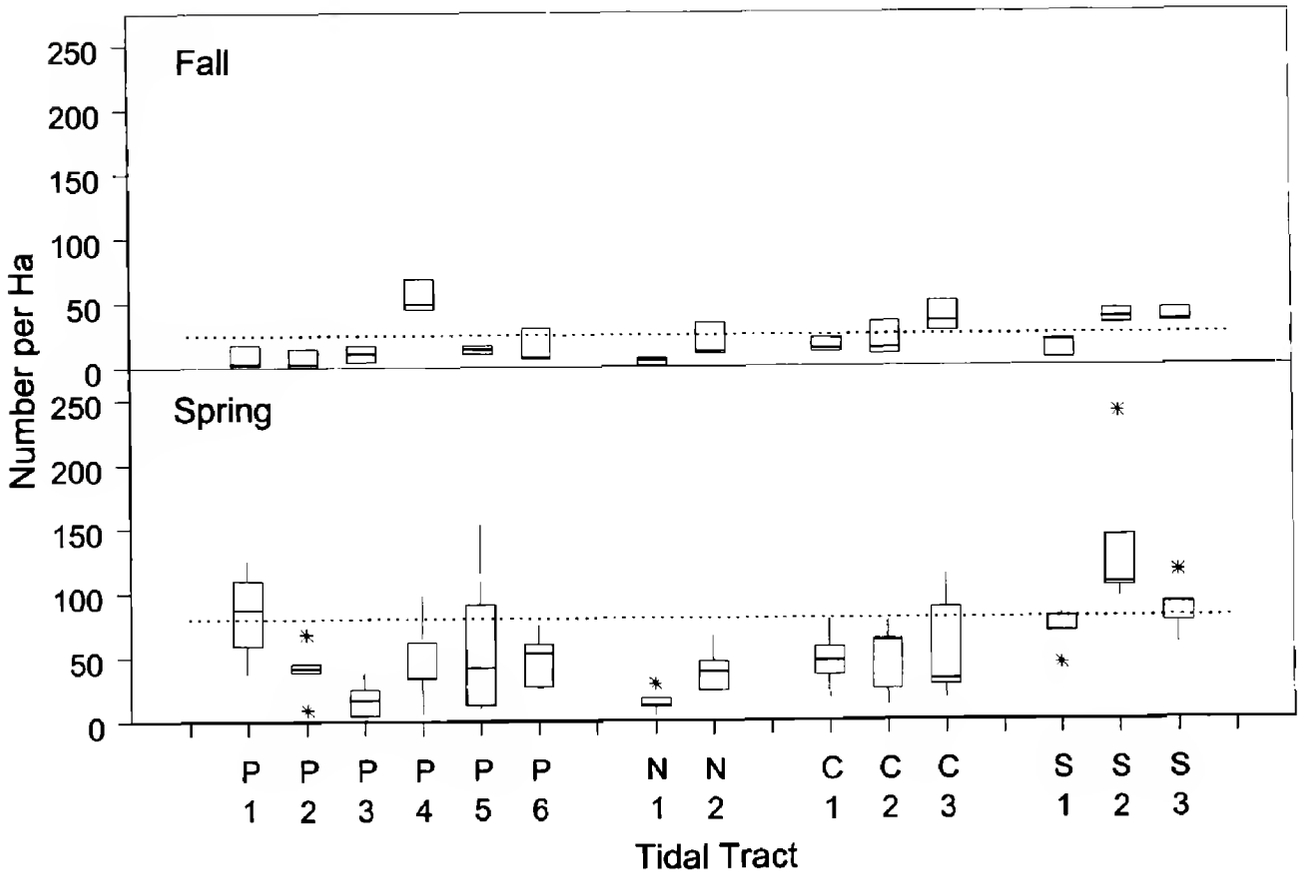
Figure 6. Biomass comparison of all shorebirds combined on 14 tidal tracts on three fall and five spring comprehensive censuses (see Figure 1 for description of tracts). Central 50% of data (interquartile range) for each tidal tract indicated by boxes, medians by thicker lines in boxes, data within 1.5 times interquartile range of boxes by vertical whiskers on boxes, and outlying values (beyond limit of whiskers) by asterisks.

Figure 7. Density comparison of *Calidris* sandpipers on 14 tidal tracts of the bay on three fall and five spring comprehensive censuses. See Figure 1 for description of tracts and Figure 6 for description of boxplots. Dashed horizontal reference lines indicate the maximum overall density for this species group in the bay; all plotted data lie above the reference line for consistent high use of tidal tracts, and median lies above reference line for frequent high use of tidal tracts.

Shorebird Biomass



Western Sandpiper, Least Sandpiper, & Dunlin



less than 10 dowitchers/ha but were consistently higher in San Leandro Bay (Figure 8).

The Napa River flats (P4), San Leandro Bay (C2), and Hayward Shoreline (C3) were tidal tracts of consistent high use for the Marbled Godwit in fall (Figure 9). Tracts of frequent high use were the northwest shore of SPB (P2) and south end of SFS (S3) in fall and San Leandro Bay, Hayward Shoreline, and the east shore of SFS (S2) in spring (Figure 9). Densities were usually less than 6 godwits/ha but were occasionally higher in spring (Figure 9).

American Avocet and Willet densities were higher on most tidal tracts in fall than in spring. Densities of 0.5–1.5 avocets and 1–3 Willets per hectare were common in fall, while spring densities were usually less than 0.5 avocets and 0.5 Willets/ha (Figures 10 and 11). Tracts with fall densities consistently exceeding the fall benchmark for the Willet were the Napa River (P4), San Leandro Bay (C2), and the east shore of SFS (S2). Tracts with densities frequently exceeding the benchmark were the Napa River flats and Hayward Shoreline (C3) for the avocet in fall, the south end of SFS (S3) for the Willet and avocet in fall, and San Leandro Bay and the east shore of SFS for the Willet in spring (Figures 10 and 11). Median avocet densities did not exceed benchmarks on any single tidal tract in spring.

Black-bellied Plover densities also were higher in fall than in spring on most tidal tracts (Figure 12). In fall, most densities did not exceed 3 plovers/ha, but like the Willet's, were consistently highest on the Napa River flats (P4), San Leandro Bay (C2), and the east shore and south end of SFS (S2 and S3), and frequently high on the east shore of SFN (N2) (Figure 12). Spring densities rarely exceeded 1 plover/ha, except in SFS, and did not exceed the spring maximum overall density on more than half of the censuses in any tidal tract (Figure 12).

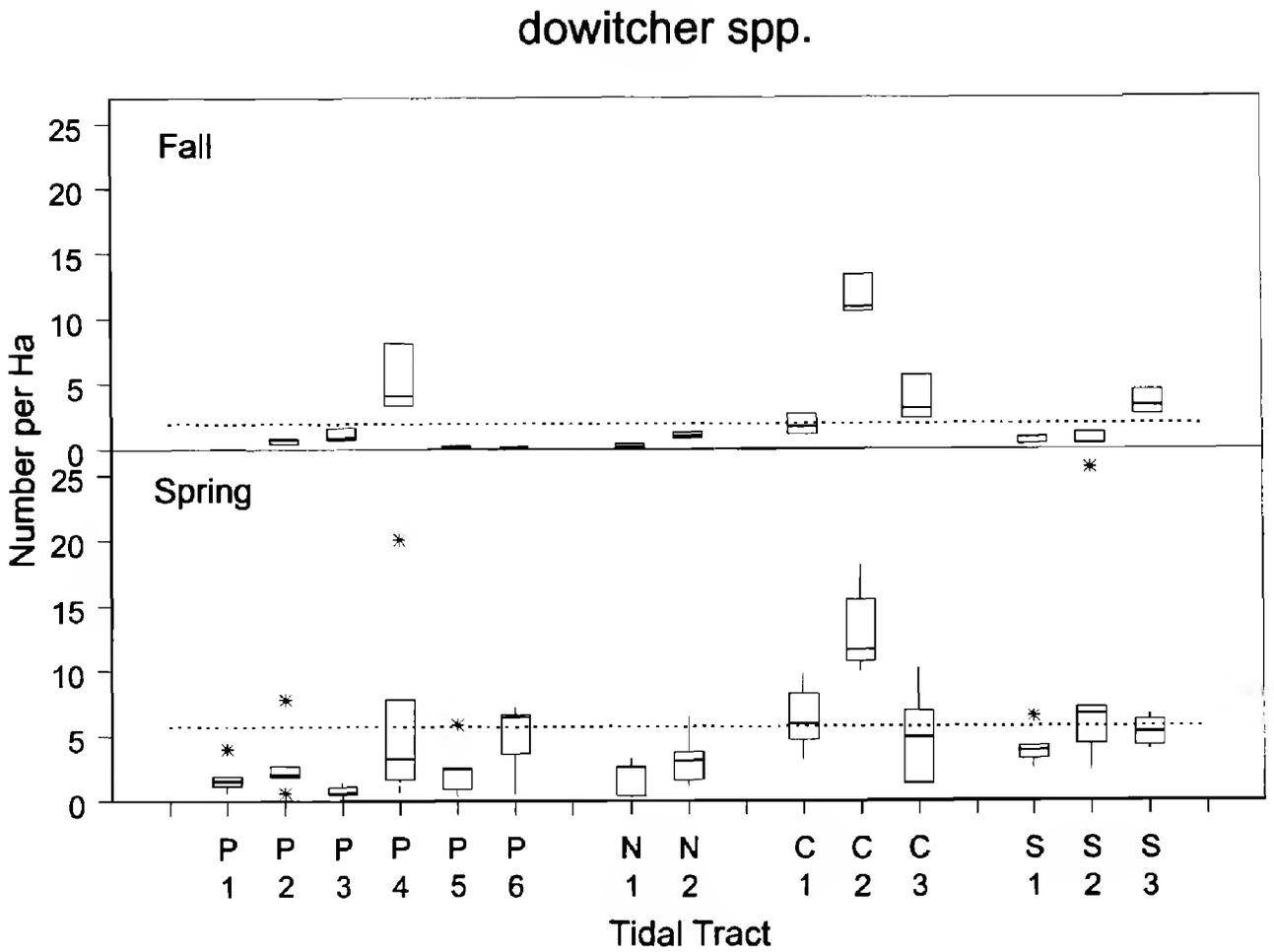
Densities of two highly localized species, the Red Knot and Sanderling, seldom exceeded 2 Sanderlings/ha and 3 knots/ha in fall and 0.5 individuals/ha of either species in spring, but each reached about 5 individuals/ha on one survey. Hayward Shoreline (C3) got consistent high use by Red Knots in fall, and east SPB (P5) and Hayward Shoreline got frequent high use in spring (Figure 13). Consistent high-use areas for the Sanderling were the east shore of SFN (N2) and San Leandro Bay (C2) in both fall and spring; the east shore of SPB was a frequent high-use tract in spring (Figure 14).

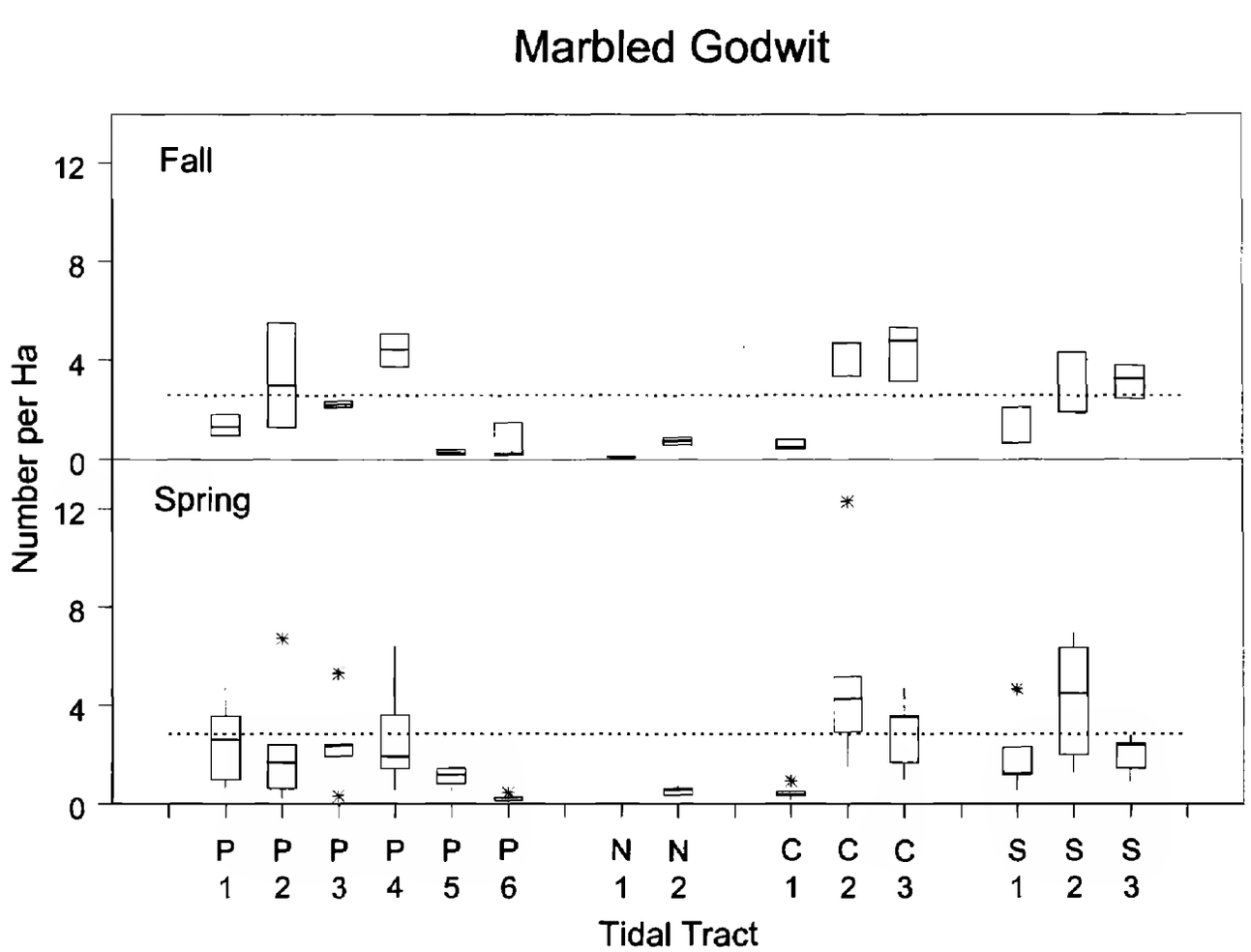
Semipalmated Plovers usually occurred at densities of less than 0.5 plovers/ha. In fall, their densities on the west shore of SFC (C1) and at the south end of SFS (S3) were consistently higher than the species' maximum overall density (Figure 15). Frequent high-use tidal tracts for this species

---

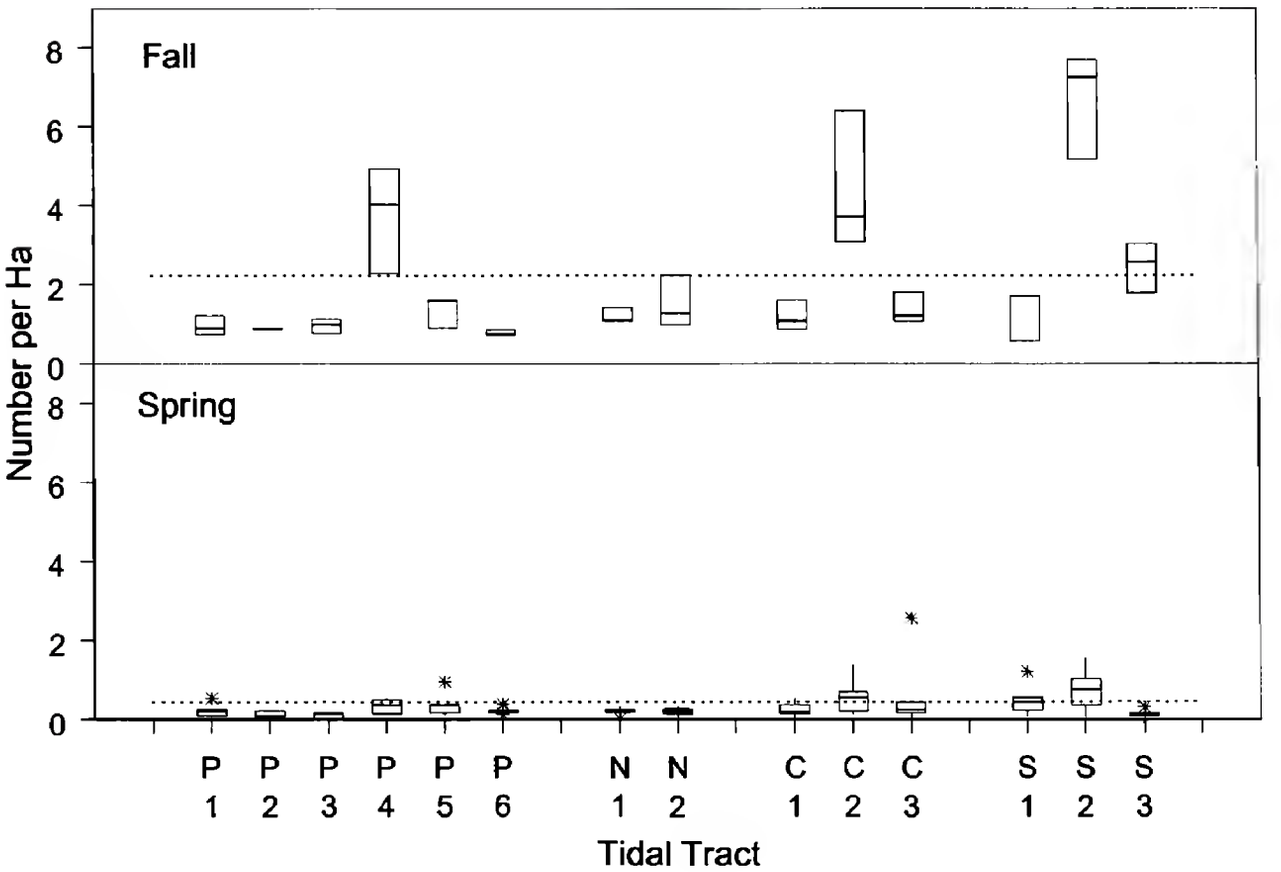
Figure 8. Density comparison of dowitchers on 14 tidal tracts of the bay on three fall and five spring comprehensive censuses. See Figure 1 for description of tracts and Figures 6 and 7 for boxplot specifications.

Figure 9. Density comparison of Marbled Godwits on 14 tidal tracts of the bay on three fall and five spring comprehensive censuses. See Figure 1 for description of tracts and Figures 6 and 7 for boxplot specifications.

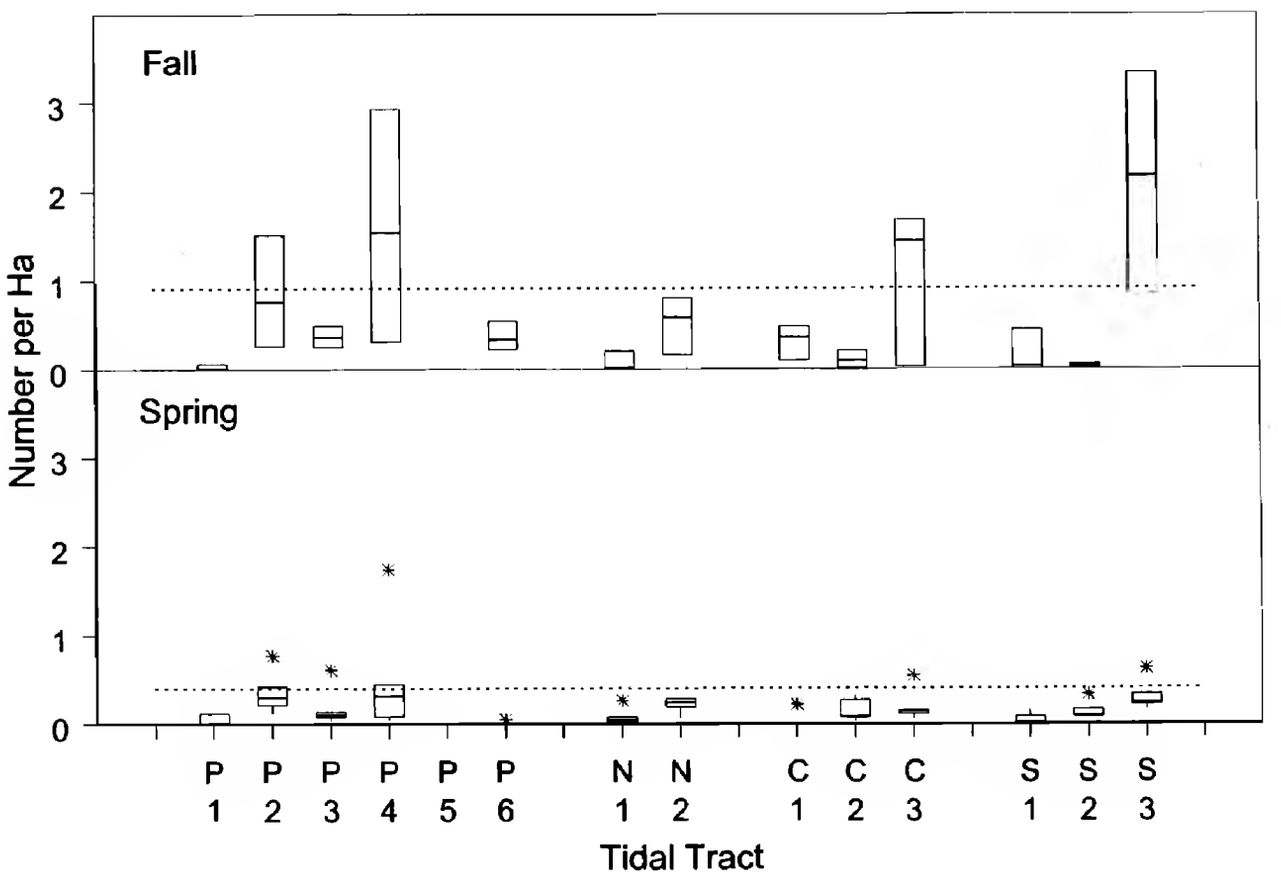

dowitcher spp.
Fall
Spring
Number per Ha
25
20
15
10
5
0
P 1
P 2
P 3
P 4
P 5
P 6
N 1
N 2
C 1
C 2
C 3
S 1
S 2
S 3
Tidal Tract


Marbled Godwit
Fall
Spring
Number per Ha
12
8
4
0
P 1
P 2
P 3
P 4
P 5
P 6
N 1
N 2
C 1
C 2
C 3
S 1
S 2
S 3
Tidal Tract

Willet



American Avocet



included San Leandro Bay (C2) and the west and east shores of SFS (S1 and S2) in fall, and five geographically scattered tracts in spring (Figure 15).

Long-billed Curlew densities in fall were consistently high on the Napa River flats (P4) and the northeast shore of SPB (P3) and also were frequently high on the northwest shore of SPB (P2). Densities usually did not exceed 0.5 curlews/ha (Figure 16). Spring densities were much lower, only once exceeding 0.2 curlews/ha, and the median did not exceed the maximum overall density in any tidal tract.

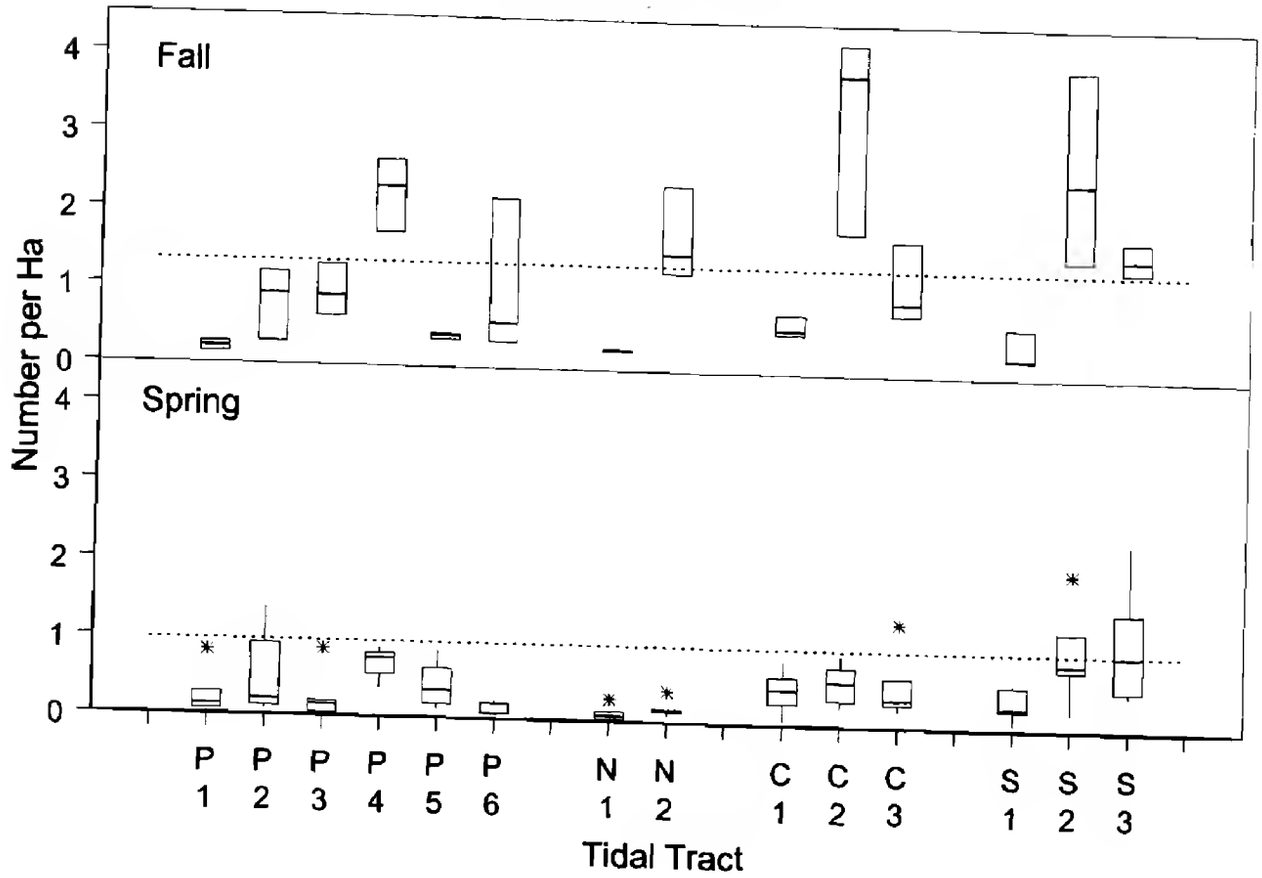
Less common species groups also consistently or frequently occurred in some tidal tracts at densities greater than their maximum overall density for the season. The Hayward Shoreline (C3) was the only tidal tract that stood out as a high-use area for the Snowy Plover; this area frequently held high densities in both fall and spring. The Hayward Shoreline is close to one of the Snowy Plover's major salt-pond breeding areas. The Killdeer was consistently at highest densities in both tidal tracts of SFN and in San Leandro Bay (C2) in both fall and spring, and on the east shore of SPB (P5) and on Hayward Shoreline in fall. Frequent high-use areas for the Killdeer were the northwest shore of SPB (P2) and the Napa River flats (P4) in spring. Yellowlegs consistently concentrated in high densities along Hayward Shoreline in fall and in San Leandro Bay in spring; the west shore of SFN (N1) was also a frequent high-use area in spring. The Whimbrel was the only species to concentrate consistently at both seasons on the west shore of SFC (C1); it also consistently occurred at high densities on the east shore of SFN (N2) in spring. Frequent high-use areas for the Whimbrel included the northeast shore of SPB (P3) and east shore of SFN in fall, the Napa River flats, southeast shore of SPB (P6), west shore of SFN (N1), and San Leandro Bay in spring. Rocky-coast species concentrated consistently on the east shore of SFN (N2) and along Hayward Shoreline (C3) in fall. Frequent high-use areas for this species group were the east shores of SPB and SFN, and the west shore of SFC during spring.

In the southern two regions of San Francisco Bay, we found that densities of many species groups tended to be higher on the eastern than the western side of the bay (Figures 6–14, 16). The only cases in which densities were higher on the west than on the east shore were in SFC for the Semipalmated Plover in fall (Figure 15) and for the Whimbrel at both seasons.

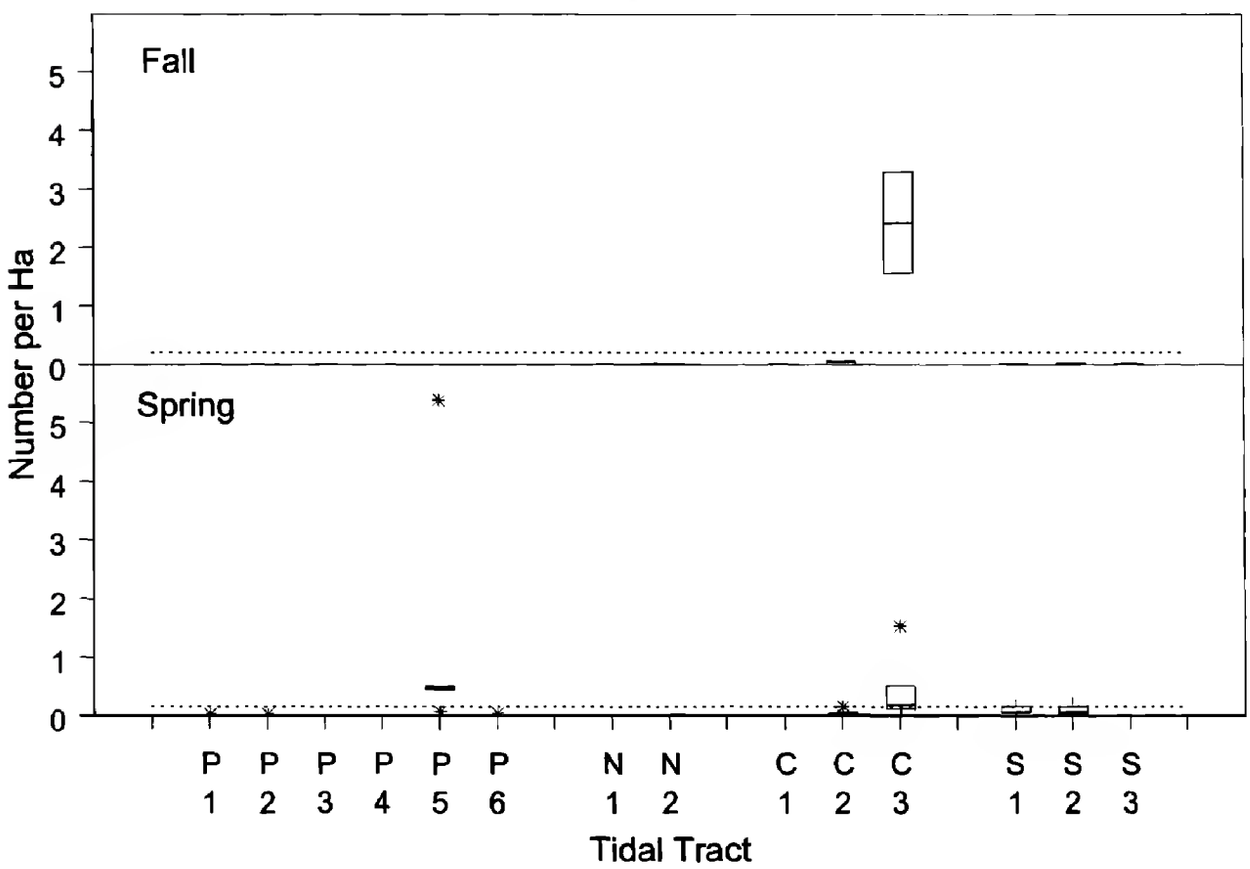
Figure 10. Density comparison of Willets on 14 tidal tracts of the bay on three fall and five spring coFigure 10. Density comparison of Willets on 14 tidal tracts of the bay on three fall and five spring comprehensive censuses. See Figure 1 for description of tracts and Figures 6 and 7 for boxplot specifications.

Figure 11. Density comparison of American Avocets on 14 tidal tracts of the bay on three fall and five spring comprehensive censuses. See Figure 1 for description of tracts and Figures 6 and 7 for boxplot specifications.

Black-bellied Plover



Red Knot



DISCUSSION

Total Numbers and Distribution Patterns of Shorebirds within the Bay

The primary purpose of these censuses was to provide an estimate of shorebird abundance in the bay against which future estimates could be compared. The shorebird numbers we recorded were the largest yet documented for the bay, owing largely to the completeness of our coverage relative to previous studies. Unfortunately, no details from regions or smaller areas of the bay are available from the Fish and Game study (Bollman et al. 1970, Gill 1972) that might allow comparisons between those 1964–65 censuses and our numbers. The distributions by region, habitat, and tidal tract we describe can provide baselines for subareas of the bay should coverage of the entire bay not be feasible in the future.

The concentrations of some species we observed within the bay were related to the distribution of important intertidal and supralittoral habitats, particularly rocky intertidal shoreline and salt ponds. Most natural and artificial rocky shoreline occurs on mainland and island shorelines of SFN. Gravelly beaches are present in portions of SFN and the eastern shoreline of SPB and in SFC. Species typical of rocky coasts concentrated in these areas on our censuses. We covered only the accessible rocky shoreline near tidal flats. Had our censuses covered all rocky shoreline in the bay the high concentration of rocky-coast species in SFN undoubtedly would have been even greater than it was.

Clearly, the location (in SFS) of most of the salt ponds influenced the distribution of salt-pond specialists. For the Snowy Plover, Black-necked Stilt, and American Avocet, this pattern arises partly because they use salt ponds for breeding. For other species (phalaropes and yellowlegs), the pattern suggests that they must be finding adequate prey within the ponds at all tides.

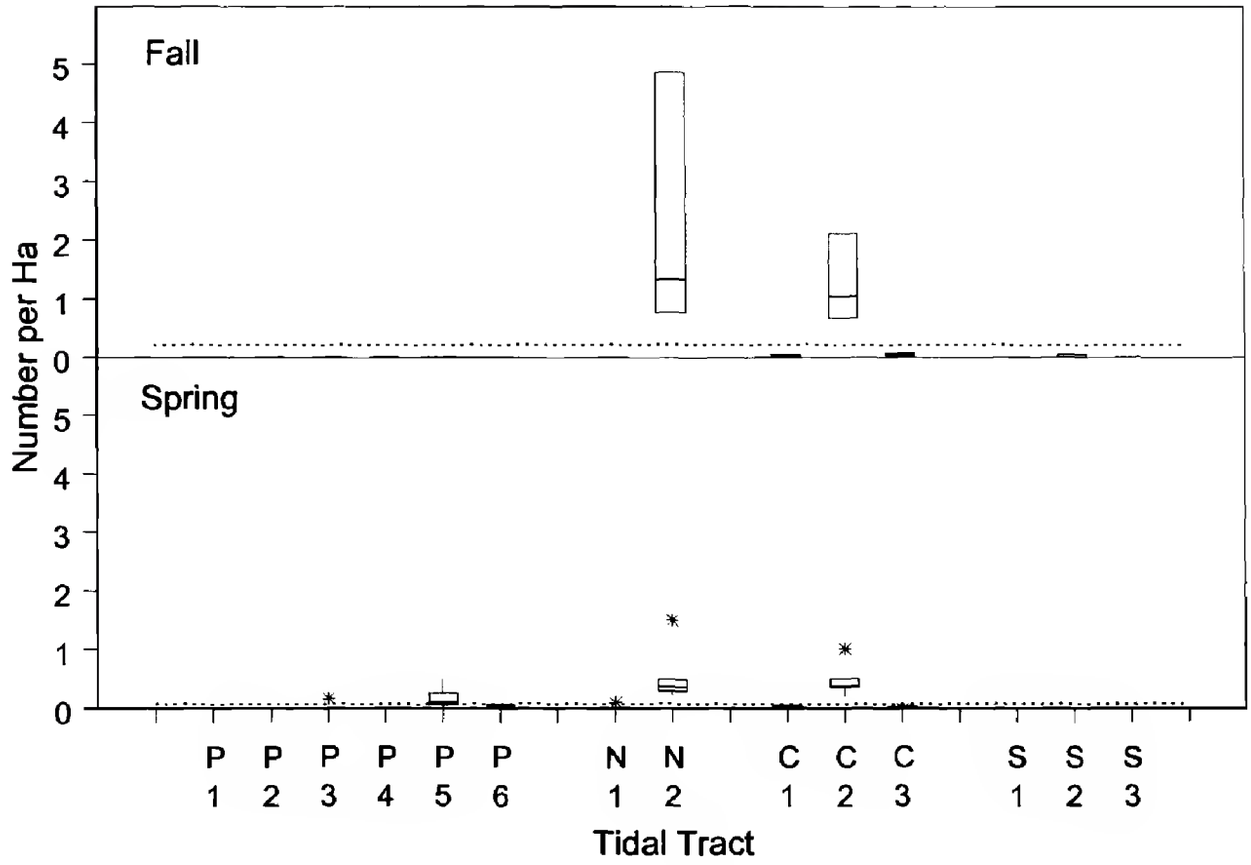
The distribution of species that feed primarily on the tidal flats at low tide ("tidal-flat specialists") also may be influenced by salt ponds. Salt ponds and levees are important as high-tide roosting areas for tidal-flat specialists, but the ponds may provide these birds still other values. Since the ponds' water levels do not change with the tides, shorebirds can feed in shallow salt ponds throughout the tidal cycle. Salt ponds, therefore, may also provide high-tide feeding areas for tidal-flat specialists, particularly when the birds' energy demands are increased. This effect could increase the number of shorebirds that a nearby tidal flat would otherwise support. On our censuses, a high proportion of Black-bellied Plovers, Willets, Marbled Godwits, small sandpipers, and dowitchers were concentrated in SFS. We also consistently found high fall densities for at least six species groups on the Napa River

---

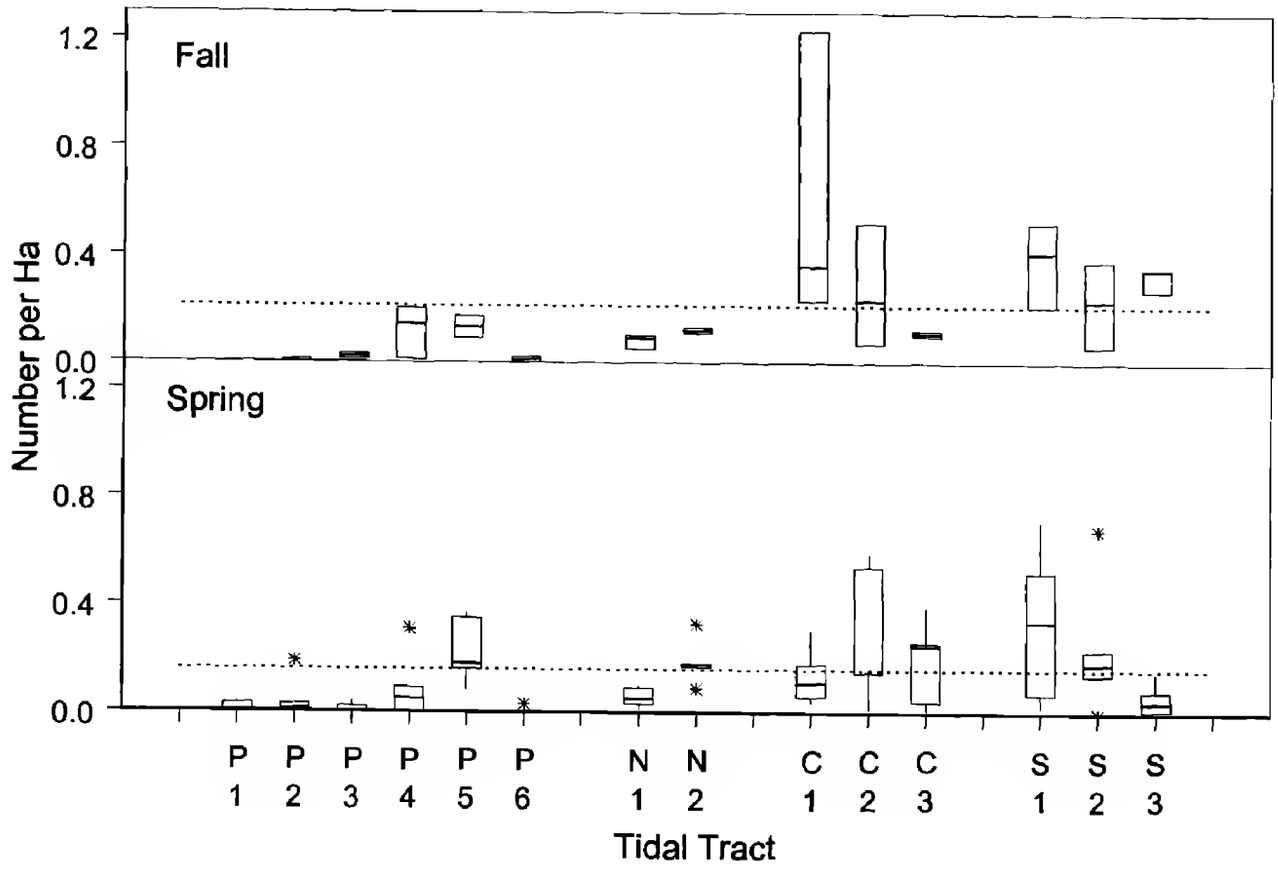
Figure 12. Density comparison of Black-bellied Plovers on 14 tidal tracts of the bay on three fall and five spring comprehensive censuses. See Figure 1 for description of tracts and Figures 6 and 7 for boxplot specifications.

Figure 13. Density comparison of Red Knots on 14 tidal tracts of the bay on three fall and five spring comprehensive censuses. See Figure 1 for description of tracts and Figures 6 and 7 for boxplot specifications.

Sanderling



Semipalmated Plover



flats, the only tidal tract immediately adjacent to salt ponds in SPB. In ongoing studies of avian use of the salt ponds throughout the tidal cycle we have found all these species except the Black-bellied Plover feeding at least irregularly in salt ponds (PRBO unpubl. data).

Studies in other estuarine systems comprising tidal flats, tidal marshes, and salt ponds (or other diked wetlands) reveal that shorebirds use salt ponds and, sometimes, salt marshes as foraging areas. In a South African estuary, Velasquez and Hockey (1992) found several species feeding in both salt ponds and salt marshes at both high and low tides, although other species, notably the Black-bellied Plover, rarely foraged in these areas. In diked managed wetlands in South Carolina, Weber and Haig (1996) observed densities in diked wetlands managed for waterfowl higher than observed even in nearby tidal areas. On Cadiz Bay, Spain, Masero et al. (2000) found some species feeding primarily in the salt ponds, some primarily on the tidal flats, and others in both habitats. All three studies found that use of salt ponds for foraging increased in the premigratory and migratory periods. Both Velasquez and Hockey (1992) and Masero et al. (2000) suggested that the availability of supratidal habitat contributes significantly to the maintenance of relatively high densities of wintering shorebirds in nearby tidal areas. There is much evidence suggesting that shorebirds use diked managed wetlands, including salt ponds, in preference to natural tidal marsh in San Francisco Bay (Bollman et al. 1970, Warnock and Takekawa 1996, PRBO unpubl. data) and elsewhere (Burger et al. 1982, Burger 1984, Davidson and Evans 1986, Burton et al. 1996, Erwin 1996, Weber and Haig 1997). For example, Burger et al. (1982) compared birds' use of varying wetland habitats and found that diked managed wetlands held significantly more species and individuals of shorebirds than did natural salt marshes. Bollman et al. (1970) censused all waterbirds on ebbing tides at many of the areas we covered in the bay and also found very low use of salt marsh by all waterbirds (excluding the Rallidae). There were only occasional reports of shorebirds using salt marsh on any of our surveys of the bay. Because of the deliberately limited set of conditions under which we conducted our censuses, though, we cannot infer a lack of use of a habitat or an area at other periods of the tidal cycle. A full assessment of the values of different areas and habitats of the bay to shorebirds will require knowledge of habitat use throughout the daily tidal cycle at all seasons.

Conservation of Shorebirds in the Bay

San Francisco Bay is one of the largest and most modified estuaries in the United States. Major historic physical changes include greatly accelerated sediment accretion as a result of the Gold Rush and diking of tidal marshes

---

Figure 14. Density comparison of Sanderlings on 14 tidal tracts of the bay on three fall and five spring comprehensive censuses. See Figure 1 for description of tracts and Figures 6 and 7 for boxplot specifications.

Figure 15. Density comparison of Semipalmated Plovers on 14 tidal tracts of the bay on three fall and five spring comprehensive censuses. See Figure 1 for description of tracts and Figures 6 and 7 for boxplot specifications.

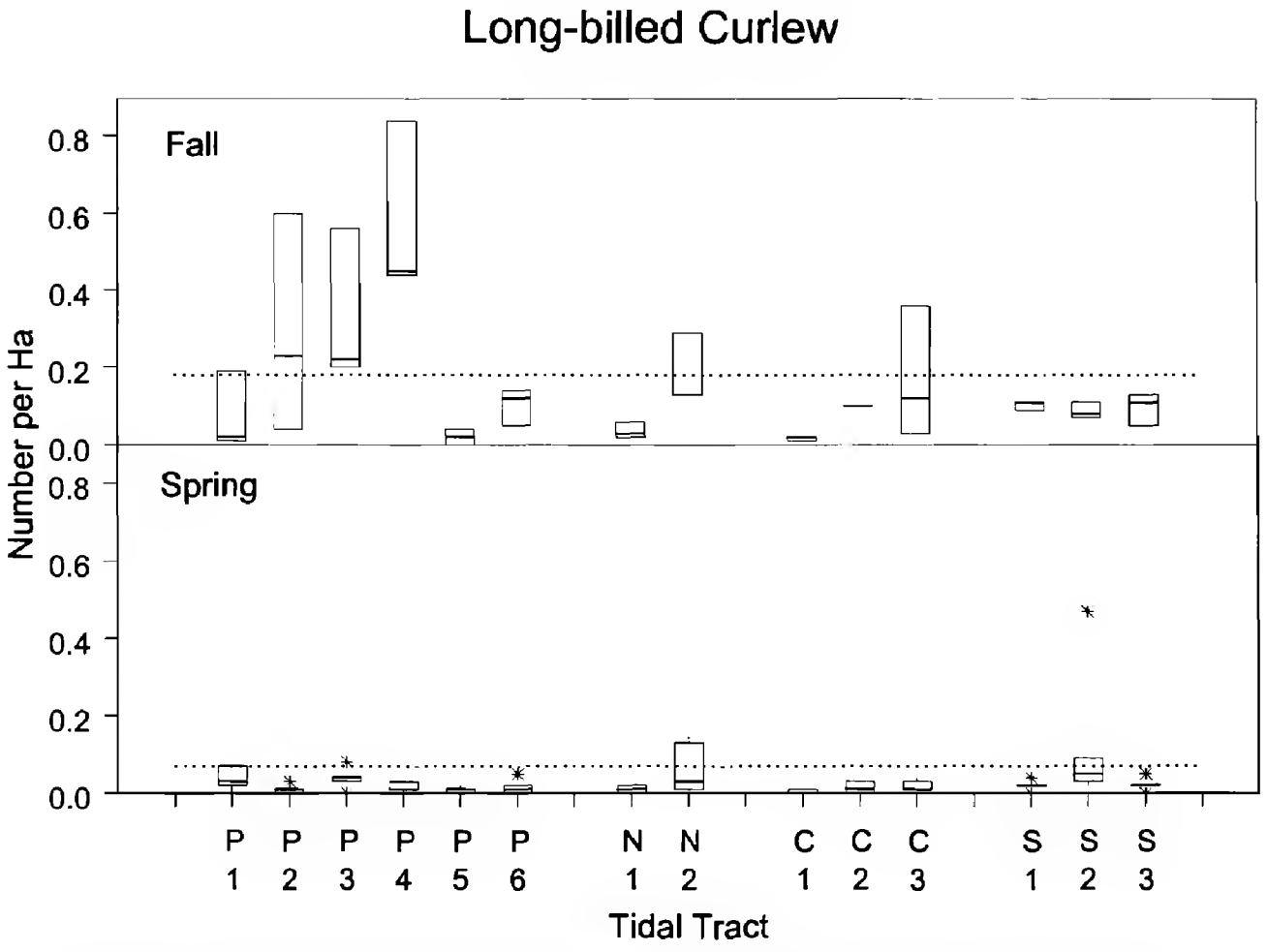


Figure 16. Density comparison of Long-billed Curlews on 14 tidal tracts of the bay on three fall and five spring comprehensive censuses. See Figure 1 for description of tracts and Figures 6 and 7 for boxplot specifications.

and flats to create farmland and salt-evaporation ponds and to allow residential and industrial development. Within our study area, tidal flats have decreased 43% from 19,440 ha in 1850 to the present 11,340 ha. Tidal marsh has decreased 79% from 50,220 to 10,530 ha (Steere and Schaefer 2000). It is unlikely that the number of shorebirds the bay supports has been immune to these habitat losses; however, without historical population estimates for the bay and the west coast, it is difficult to deduce which species, other than salt-pond specialists, have increased or decreased in abundance.

Debate over the ecological costs and benefits of the impoundment of marshes continues. Many species dependent on tidal marshes have suffered significant population declines, and conservation plans for the bay region call for restoration of much of the bay's diked wetlands, including active and inactive salt ponds, to tidally influenced marsh (Goals Project 1999, Steere and Schaefer 2000). To preserve biological resources and diversity in the bay, the needs of the many species (e.g., colonial waterbirds, waterfowl, and shorebirds) that may have benefited from the creation of other types of wetland cannot be neglected; these wetlands currently may provide compen-

satory habitat for species that have suffered loss of unvegetated tidal habitat in the bay or loss of wetlands in other portions of their range (Harvey et al. 1992). Currently, the bay is one of only a few sites in North America that regularly holds shorebirds in the hundreds of thousands, sometimes up to a million.

With its current configuration and quality of wetlands, the bay is clearly critical to shorebirds, but as human and conflicting natural-resource demands increase, the fate of shorebirds here is uncertain. The demands of the expanding human population include new commercial and residential development and expansions of existing facilities such as airports and harbors, which exert both direct and indirect impacts on wetland quality, extent, configuration, and location. Tidal flats have been lost because of a number of human influences on the bay, including the spread of introduced smooth cordgrass, *Spartina alterniflora* (Callaway and Josselyn 1992). The spread of invasive *Spartina* spp. has been suggested to affect bird numbers in other estuaries by removing feeding area and by reducing feeding time (Goss-Custard and Moser 1988), thus we consider it a threat to shorebird habitat within the bay. Other anthropogenic effects include the demand for the fresh water flowing into the bay (Nichols 1979) and exotic benthic invertebrates introduced repeatedly from other estuaries through mariculture and shipping (Carlton 1979). A global rise in sea level, which has accelerated in the past 30 years over the more gradual rate of the prior 5000 years, is expected to accelerate further (SFBCDC 1988). In the bay, sea-level change combined with local subsidence may cause wetland loss where the shoreline has been developed by preventing wetlands from shifting inland (SFBCDC 1988).

Our results suggest that opportunities to reestablish habitat for shorebirds within the bay may be constrained by factors that cannot be overcome by restoration feasible in a local project. For example, considerable development pressure continues to threaten intertidal areas of SFN and SFC, where most supralittoral habitat has already been converted to residential, commercial, and transportation uses. SPB encompasses extensive diked land that could be restored to tidal habitat and is often suggested as the region where habitat loss elsewhere in the bay can be mitigated. However, shorebirds supported mainly by habitats found in SFN and SFC might not be easily accommodated in SPB. Furthermore, the comparatively low shorebird densities we found on SPB tidal flats imply that this region may require more habitat than other regions to support a given number of shorebirds. Similar constraints for these or other regions of the bay may apply to organisms other than shorebirds.

Because of the importance of the bay to shorebirds on the Pacific coast (Page et al. 1999), and because of the importance of shorebirds in the San Francisco Bay avian community (Bollman et al. 1970), wetland restoration should address shorebird habitat. Encroaching development, the limited amount of land available for wetland restoration, and the limited funds for acquisition, restoration, and management make management for multiple species and purposes daunting. Obtaining maximum habitat value from restoration and management will require identification of habitat characteristics most important to each species. Conservation planners and managers

need to be efficient and creative in devising ways to accommodate species with conflicting habitat requirements.

ACKNOWLEDGMENTS

Essential funding was provided by the Bradford Foundation, Chevron USA Inc., the Dakin Foundation, the Dean Witter Foundation, Genentech, the Marin chapter of the Audubon Society, the National Fish and Wildlife Foundation, the Packard Foundation, the San Francisco Foundation, the True North Foundation, the California Department of Fish and Game, and by individual donors to PRBO. We thank Zoltan Der and Robin Grossinger of the San Francisco Estuary Institute for their patient and skilled assistance with the portion of our analysis requiring a geographic-information system, Charles Conway of ESRI for facilitating the donation of ArcView to PRBO, and Diana Stralberg and Chris McCreedy, who designed the final maps for publication. The censuses were possible because we were granted access to the salt ponds, shoreline, and other wetlands and given logistic assistance by Don Edwards San Francisco Bay National Wildlife Refuge staff, Cargill (Leslie Salt) Company, Venture Corporation, Pacific Gas and Electric, San Francisco Bay Bird Observatory, Hayward Shoreline Interpretive Center, Coyote Point Nature Center, and bay area Audubon Society chapters. Ruth Pratt, former head of the Diked Baylands Study of the U.S. Fish and Wildlife Service, and personnel of the refuge and San Francisco Bay Bird Observatory shared their knowledge of shorebirds in the bay with us.

The field effort would not have been possible without the organizing efforts and participation of the following very helpful and committed individuals: Steve Cochran, Doug Ellis, Leora Feeney, Geoff Geupel, Kathy Hobson, Bob Hogan, Robin Leong, Bob Richmond, Mike Rippey, Dave Shuford, Larry Spear, Rich Stallcup, Nils Warnock, Sarah Griffin Warnock, and Peg Woodin. Over 100 people contributed their time and expertise as censusers; we sincerely thank everyone who participated in the project for their time, talent, and enthusiasm.

This manuscript benefited from comments provided by Anne Black, Mark Colwell, Robert Gill, and Nils Warnock. This is contribution number 886 of the Point Reyes Bird Observatory.

LITERATURE CITED

Anderson, W. 1970. A preliminary study of the relationship of salt ponds to wildlife in south San Francisco Bay. Calif. Fish and Game 56:240–252.

Bollman, F. H., Thelin, P. K., and Forester, R. T. 1970. Bimonthly bird counts at selected observation points around San Francisco Bay, February 1964 to January 1966. Calif. Fish and Game 56:224–239.

Burger, J. 1984. Abiotic factors affecting migrant shorebirds, in Shorebirds: Migration and foraging behavior (J. Burger and B. L. Olla, eds.), pp. 1–72. Plenum, New York.

Burger, J., Shisler, J., and Lesser, F. H. 1982. Avian utilization on six salt marshes in New Jersey. Biol. Conserv. 23:187–212.

Burton, N. H. K., Evans, P. R., and Robinson, M. A. 1996. Effects on shorebird numbers of disturbance, the loss of a roost site and its replacement by an artificial island at Hartlepool, Cleveland. Biol. Conserv. 77:193–201.

Callaway, J. C., and Josselyn, M. N. 1992. The introduction and spread of smooth cordgrass (*Spartina alterniflora*) in South San Francisco Bay. Estuaries 15:218–226.

Carlton, J. T. 1979. Introduced invertebrates of San Francisco Bay, in San Francisco Bay: The Urbanized Estuary (T. J. Conomos, ed.), pp. 427–444. Pac. Div. Am. Assoc. Adv. Sci., San Francisco.

Davidson, N. C., and Evans, P. R. 1986. The role and potential of man-made and man-modified wetlands in the enhancement of the survival of overwintering shorebirds. Colonial Waterbirds 9:176–188.

Dunning, J. B., Jr. 1992. CRC Handbook of Avian Body Masses. CRC Press, Boca Raton, FL.

Erwin, R. M. 1996. Dependence of waterbirds and shorebirds on shallow-water habitats in the mid-Atlantic coastal region: An ecological profile and management recommendations. Estuaries 19:213–219.

Evans, P. R., and Pienkowski, M. W. 1984. Population dynamics of shorebirds, in Shorebirds: Breeding Behavior and Populations (J. Burger and B. L. Olla, eds.), pp. 83–123. Plenum, New York.

Gill, R., Jr. 1972. Review of the bi-monthly bird counts of San Francisco Bay February 1964–February 1965. Wildlife Mgmt. Branch Admin. Rept. 72-8, Calif. Dept. Fish and Game, 1416 Ninth St., Sacramento, CA 95814.

Goals Project. 1999. Bay ecosystem habitat goals. A report of habitat recommendations prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. U.S. Environmental Protection Agency, San Francisco/San Francisco Bay Regional Water Quality Control Board, 1515 Clay St., Suite 1400, Oakland, CA 95612.

Goss-Custard, J. D., and Moser, M. E. 1988. Rates of change in the numbers of Dunlin, *Calidris alpina*, wintering in British estuaries in relation to the spread of *Spartina anglica*. J. Appl. Ecol. 25:95–109.

Harrington, B., and Perry, E. 1995. Important shorebird staging sites meeting Western Hemisphere Shorebird Reserve Network criteria in the United States. Manomet Center for Conservation Sciences, P. O. Box 1770, Manomet, MA 02345.

Harvey, T. E., Miller, K. J., Hothem, R. L., Rauzon, M. J., Page, G. W., and Keck, R. A. 1992. Status and trends report on wildlife of the San Francisco estuary. Prepared by the U.S. Fish and Wildlife Service for the San Francisco Estuary Project. U.S. Environmental Protection Agency, 2800 Cottage Way, Room E-1803, Sacramento, CA 95825-1846.

Holway, D. A. 1990. Patterns of winter shorebird occurrence in a San Francisco Bay marsh. W. Birds 21:51–64.

Kelly, P. R., and Cogswell, H. L. 1979. Movements and habitat use by wintering populations of Willets and Marbled Godwits. Studies Avian Biol. 2:69–82.

Luther, J. S. 1968. Populations and behavior of wintering Marbled Godwits in relation to tide cycles on the Hayward shore of San Francisco Bay. M. A. thesis, Calif. State College, Hayward.

Masero, J. A., Pérez-Hurtado, A., Castro, M., and Arroyo, G. M. 2000. Complementary use of intertidal mudflats and adjacent salinas by foraging waders. Ardea 88:177–191.

Nichols, F. H. 1979. Natural and anthropogenic influences on benthic community structure in San Francisco Bay, in San Francisco Bay: The Urbanized Estuary (T. J. Conomos, ed.), pp. 409–426. Pac. Div. Am. Assoc. Adv. Sci., San Francisco.

Ohlendorf, H. M., and Fleming, W. J. 1988. Birds and environmental contaminants in San Francisco and Chesapeake bays. Mar. Pollution Bull. 19:487–495.

Page, G. W., Stenzel, L. E., and Wolfe, C. M. 1979. Aspects of the occurrence of shorebirds on a central California estuary. Studies Avian Biol. 2:15–32.

Page, G. W., Stenzel, L. E., and Kjelmyr, J. E. 1999. Overview of shorebird abundance and distribution in wetlands of the Pacific coast of the contiguous United States. Condor 101:461–471.

Recher, H. F. 1966. Some aspects of the ecology of migrant shorebirds. Ecology 47:393–407.

San Francisco Bay Conservation and Development Commission. 1988. Future sea level rise: Predictions and implications for San Francisco Bay. San Francisco Bay Cons. Dev. Comm., 50 California St., Suite 2600, San Francisco, CA 94111.

Steere, J. T., and Schaefer, N., eds. 2000. Restoring the estuary: An implementation strategy for the San Francisco Bay Joint Venture. San Francisco Bay Joint Venture, 530C Alameda del Prado #139, Novato, CA 94949.

Stenzel, L. E., and Page, G. W. 1988. Results of the first comprehensive shorebird census of San Francisco and San Pablo bays. Wader Study Group Bull. 54:43–48.

Storer, R. W. 1951. The seasonal occurrence of shorebirds on Bay Farm Island, Alameda County, California. Condor 53:186–193.

Swarth, C. W., Akagi, C., and Metropulos, P. 1982. The distribution patterns and ecology of waterbirds using the Coyote Hills salt ponds. U.S. Fish & Wildlife Serv., Don Edwards San Francisco Bay Natl. Wildlife Ref., P. O. Box 524, Newark, CA 94560.

Velasquez, C. R., and Hockey, P. A. R. 1992. The importance of supratidal foraging habitats for waders at a south temperate estuary. Ardea 80:243–253.

Warnock, N., and Bishop, M. A. 1998. Spring stopover ecology of migrant Western Sandpipers. Condor 100:456–467.

Warnock, N., Page, G. W., and Sandercock, B. K. 1997. Local survival of Dunlin wintering in California. Condor 99:906–915.

Warnock, S. E., and Takekawa, J. Y. 1995. Habitat preferences of wintering shorebirds in a temporally changing environment: Western Sandpipers in the San Francisco Bay estuary. Auk 112:920–930.

Warnock, S. E., and Takekawa, J. Y. 1996. Wintering site fidelity and movement patterns of Western Sandpipers *Calidris mauri* in the San Francisco Bay estuary. Ibis 138:160–167.

Weber, L. M., and Haig, S. M. 1996. Shorebird use of South Carolina managed and natural coastal wetlands. J. Wildlife Mgmt. 60:73–82.

Weber, L. M., and Haig, S. M. 1997. Shorebird diet and size selection of nereid polychaetes in South Carolina coastal diked wetlands. J. Field Ornithol. 68:358–366.

Accepted 24 October 2001

HISTORICAL AND PRESENT BREEDING SEASON DISTRIBUTION OF STELLER'S EIDERS IN ALASKA

LORI T. QUAKENBUSH, School of Fisheries and Ocean Sciences, University of Alaska, Fairbanks, Alaska 99775-7220 (current address Alaska Department of Fish and Game, 1300 College Road, Fairbanks, Alaska 99701-1599)

ROBERT H. DAY and BETTY A. ANDERSON, ABR, Inc.— Environmental Research & Services, P. O. Box 80410, Fairbanks, Alaska 99708-0410

FRANK A. PITELKA, University of California, Museum of Vertebrate Zoology, Berkeley, California 94720-3160

BRIAN J. McCAFFERY, Yukon Delta National Wildlife Refuge, P. O. Box 346, Bethel, Alaska 99559

ABSTRACT: The Alaska breeding population of the Steller's Eider (*Polysticta stelleri*) occurs as two subpopulations, one on the Arctic coastal plain of northern Alaska, primarily near Barrow, and the other on the Yukon–Kuskokwim Delta of western Alaska. In 1997, the Alaska breeding population was listed under the Endangered Species Act as threatened because the nesting range and population were thought to have decreased substantially. The historical (pre-1970) and recent (1970–present) breeding distribution and abundance of Steller's Eiders, however, are not well known. We compiled and evaluated the historical and recent records of breeding-season distribution, confirmed nesting for northern and western Alaska, and found that the overall sizes of the breeding ranges have not changed substantially; however, the frequency of breeding has decreased in both regions, except near Barrow. Causes of this reduction in breeding frequency of Steller's Eiders in Alaska are unknown, but changes in predator populations, lead poisoning, and interspecific nesting associations with Snowy Owls (*Nyctea scandiaca*) and Pomarine Jaegers (*Stercorarius pomarinus*) may be contributing factors.

Three geographically distinct breeding populations of Steller's Eiders (*Polysticta stelleri*) are recognized, two in arctic Russia and one in Alaska, with the greatest numbers occurring in the eastern Russian Arctic (Nygård et al. 1995; Figure 1). The Alaska breeding population is the smallest of the three and comprises two geographic subpopulations, one on the Arctic coastal plain of northern Alaska, the other on the Yukon–Kuskokwim Delta of western Alaska. The Alaska breeding population was listed as threatened under the Endangered Species Act in 1997 because it was thought that the species' nesting range in Alaska had decreased substantially and that the overall number of birds nesting in Alaska probably had decreased substantially as well (U.S. Federal Register 62:31748–31757). That decision, however, was based on little information. In this paper, we summarize and evaluate the historical (pre-1970) and recent (1970–present) breeding distribution and frequency of Steller's Eiders in Alaska and discuss possible reasons for changes.

METHODS

We compiled both positive (presence) and negative (absence) observations on the breeding-season distribution and breeding frequency of Steller's Eider in Alaska from published and unpublished literature, museum records,

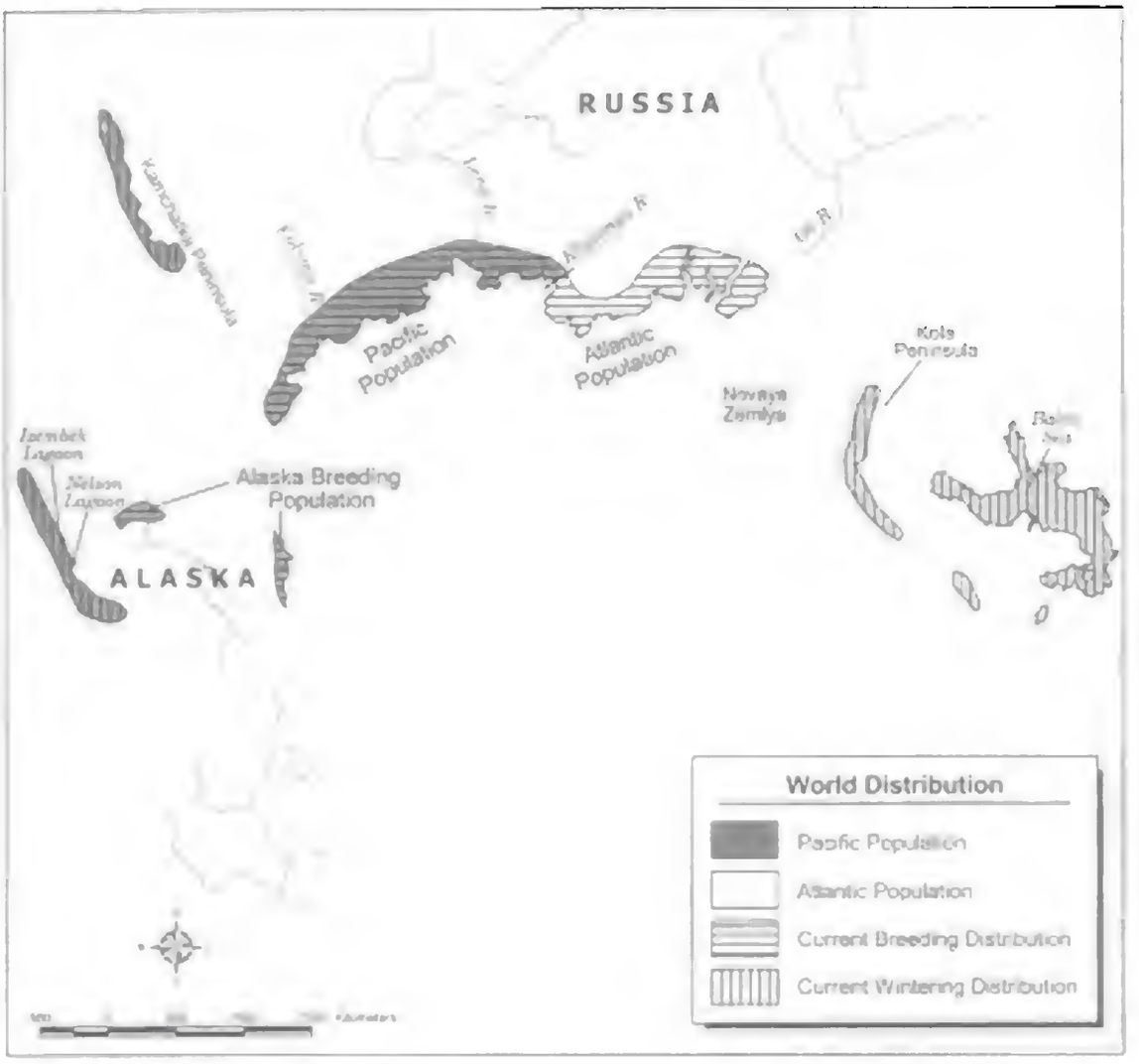


Figure 1. The current breeding and wintering ranges of Steller's Eider. The bar at the mouth of the Khatanga River in Russia marks the boundary between Pacific and Atlantic populations.

personal communications, and field notes (also see Boarman and Coe 2000). We used daily or seasonal bird lists when they existed because study reports did not always report on nonfocal species. Positive records included Steller's Eiders seen during the breeding season (May–September) and only on land or fresh water; known migrants and molting concentrations were excluded. Negative records included visits to a specific location within the historical range of Steller's Eider, during the breeding season, in which no Steller's Eiders or evidence of nesting were observed. Because Quakenbush and Suydam (1999) found that Steller's Eiders did not nest annually near Barrow in the 1990s, despite being present, we made a distinction between sightings ("occurrence") and evidence of nesting ("breeding"). We did not include observations from aerial surveys because these surveys do not yield evidence for nesting, but we did summarize the distribution of aerial-survey observations to compare them with those made from the ground.

To compare the past and present data sets for possible declines in either the occurrence or breeding frequency of Steller's Eiders, we divided the records into historical (pre-1970) and recent (1970–present). We chose

1970 as the division between periods because of the increase in multiyear ornithological studies that began on the Arctic coastal plain in conjunction with oilfield development and studies in the Yukon–Kuskokwim Delta that expanded and intensified about that time.

We tabulated numbers of site-years of occurrence and breeding during each period. A site-year reflects data for one year at a particular location (site) during the breeding season. Observations ranged from single-day site visits to multi-month studies. Potential problems exist because of the greater effort in a longer-term study and because few sites have been visited with equal effort in both periods. To reduce the effects of this possible bias, we compared pooled data from all sites with data from a subset of sites that had been visited in both periods.

A compilation of site data by period allows a qualitative estimate of distribution and breeding frequency of Steller's Eiders in Alaska. Because of the qualitative nature of these data, these frequencies are not estimates of absolute change but reveal trends of occurrence and breeding.

RESULTS

Northern Alaska

Historical data suggest that Steller's Eiders formerly occurred across much of the Arctic coastal plain [Anderson 1913, Brooks 1915, Bailey 1925, 1948, Bent 1925, Bee 1958, Fiscus 1952 in Gabrielson and Lincoln 1959, Gill et al. 1985, Quakenbush and Cochrane 1993; egg collections in the Western Foundation of Vertebrate Zoology, Camarillo, California (WFVZ), and Denver Museum of Natural History, Denver, Colorado (DMNH; Figure 2)]. They also were recorded in northwestern Canada as far east as Cape Bathurst, Northwest Territories, and in four of five pre-1970 site-years between Kaktovik and Cape Bathurst, Northwest Territories, suggesting that the species formerly occurred there regularly (Anderson 1913, Brooks 1915, Dixon 1943).

Although the species apparently ranged widely over the Arctic coastal plain and into northwestern Canada, unequivocal historical evidence of nesting is available only from Wainwright to Cape Halkett in Alaska (Bailey 1925, 1948, Stone 1900 in Gabrielson and Lincoln 1959, Bee 1958; egg collections in WFVZ, DMNH, and Museum of Vertebrate Zoology, University of California, Berkeley; Figure 2). Verbal accounts of nesting include locations as far east as the Colville River Delta (P. Sovalik in Myres 1958) and Collinson Point near Kaktovik (W. Patkotak in Quakenbush and Cochrane 1993), but there are no definitive historical records of nesting east of Cape Halkett. Regardless of the eastern limit of nesting, the species occurred and nested with greatest frequency in the vicinity (within 20 km) of Barrow (Myres 1958, Gabrielson and Lincoln 1959, Pitelka 1974, Quakenbush and Suydam 1999) and, secondarily, elsewhere within the Arctic coastal plain at least as far east as Cape Halkett (Figure 2).

Recent occurrence extends from Wainwright to the Sagavanirktok River, with one record from Herschel Island, Yukon Territory, Canada (Talarico and Mossop 1986); however, there are no recent sightings between the Sagavanirktok River and the Alaska–Canada border (Figure 3). In addition,

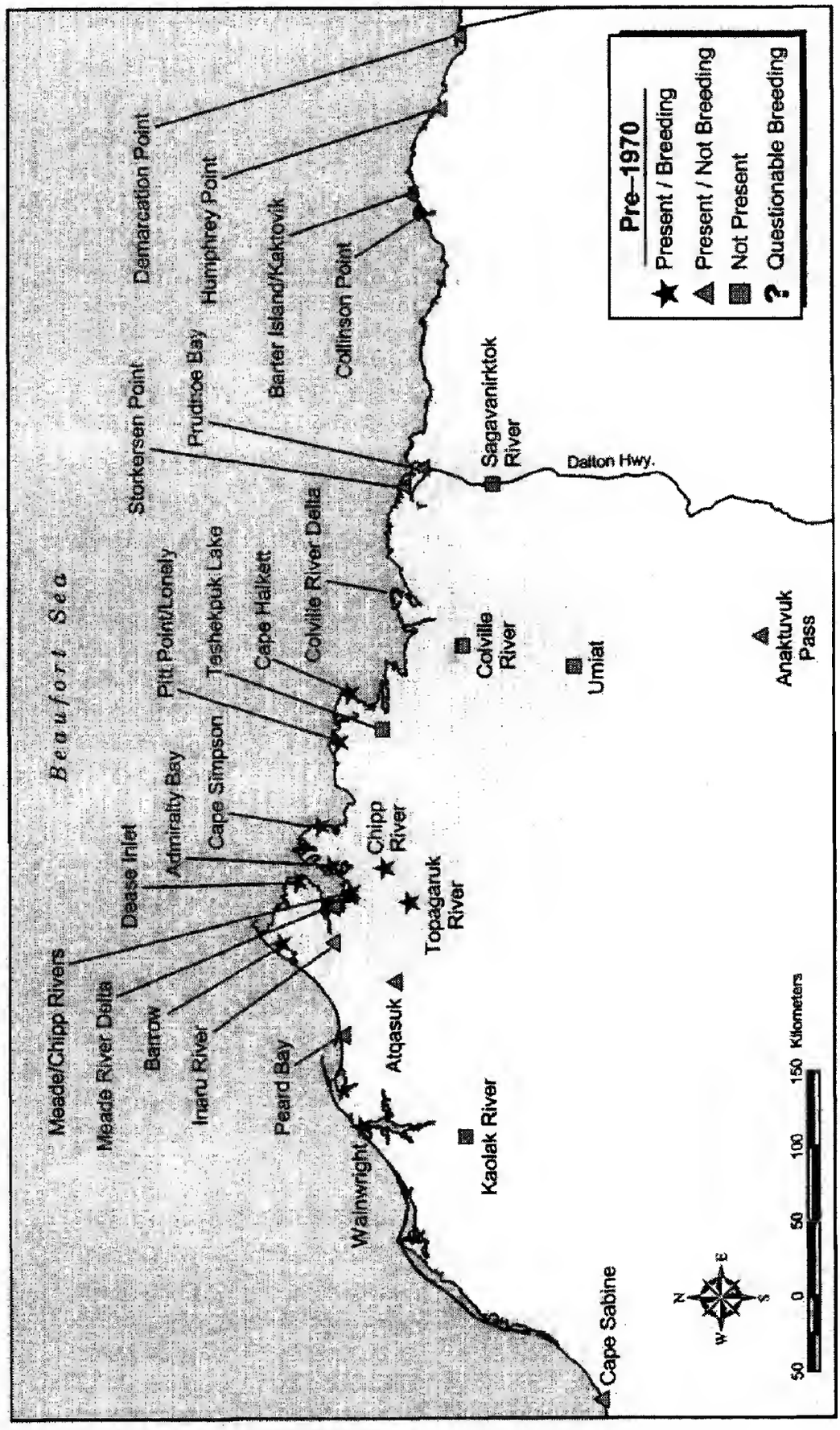


Figure 2. The occurrence and breeding distribution of Steller's Eider in northern Alaska (May–September) before 1970.

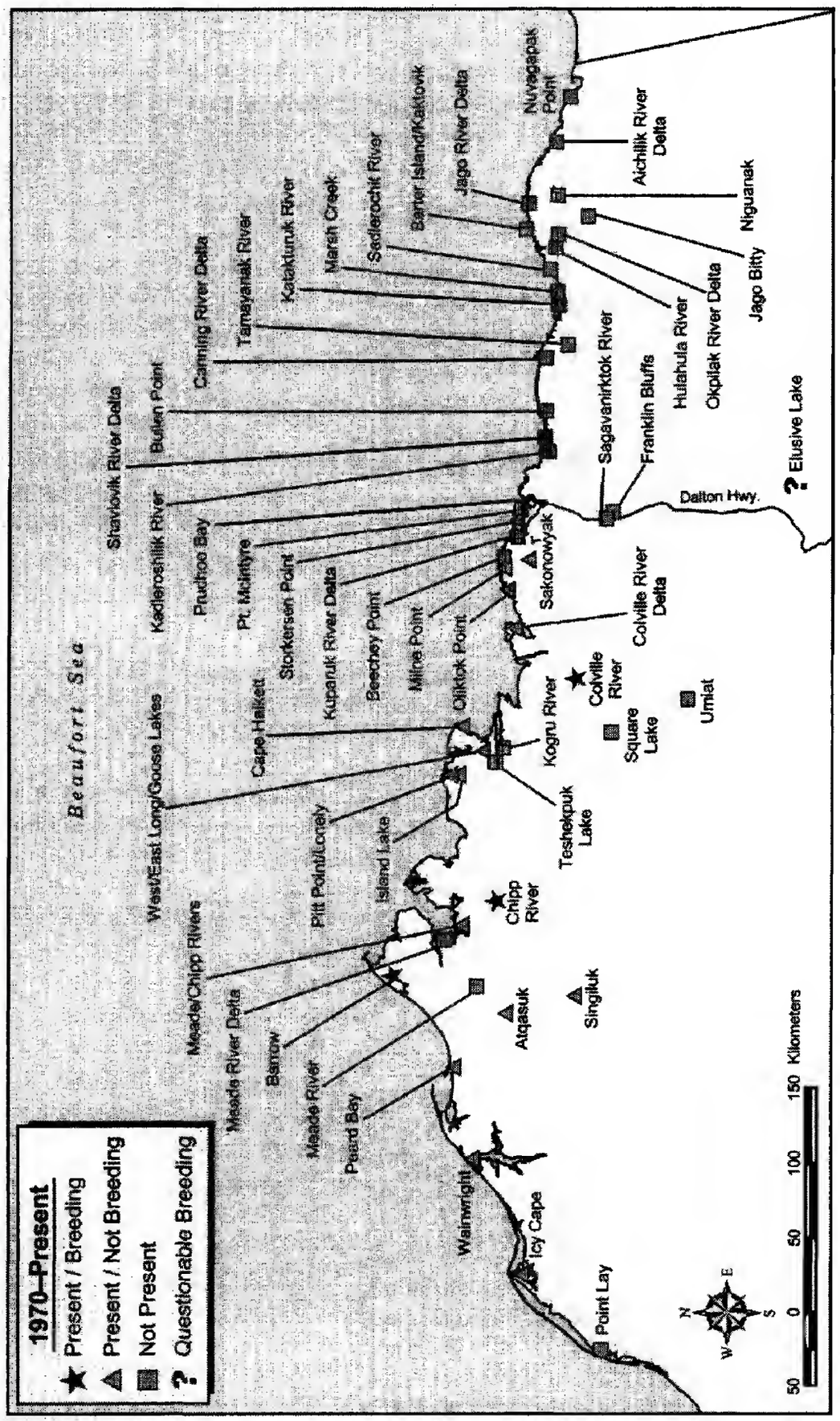


Figure 3. The occurrence and breeding distribution of Steller's Eiders in northern Alaska (May–September) since 1970.

aerial surveys flown annually between 1989 and 1999 have accumulated sightings of 436 Steller's Eiders at 180 locations on the Arctic coastal plain (Larned et al. 1993, Brackney and King 1993, 1994, Balogh and Larned 1994, Larned and Balogh 1994, King and Brackney 1995, King and Dau 1997). These surveys found that Steller's Eiders were widely distributed between Point Lay and the Sagavanirktok River, with only three sightings between the Colville and Sagavanirktok rivers and the highest densities near Barrow. An aerial survey flown near Barrow, Admiralty Bay, and Meade River in 1999 and 2000 also found Steller's Eiders to be most common near Barrow (Ritchie and King 2001).

Recent unequivocal nesting records range from Barrow to inland on the Colville River (Figure 3), with the Barrow area still being the center of abundance and primary nesting location in northern Alaska. There is no unequivocal evidence of recent nesting east of the Colville River, despite extensive fieldwork in this region. M. M. Johnson (Univ. of Calif., Davis, pers. comm.) saw a flight-capable brood on Lake Colleen, near the Sagavanirktok River, and K. Russell [U.S. Fish and Wildlife Service (USFWS), Fairbanks, pers. comm.] saw a flight-capable brood on Elusive Lake in the Brooks Range; however, these birds may have flown considerable distances from their breeding sites.

Occurrence and breeding status are available from the Arctic coastal plain for 106 historical and 151 recent site-years. Steller's Eiders were recorded during 75% of historical site-years but only 36% of recent site-years (Figure 4). Breeding frequency, based on years of occurrence, was 49% of historical site-years but 33% of recent ones (Figure 5). Fourteen sites between

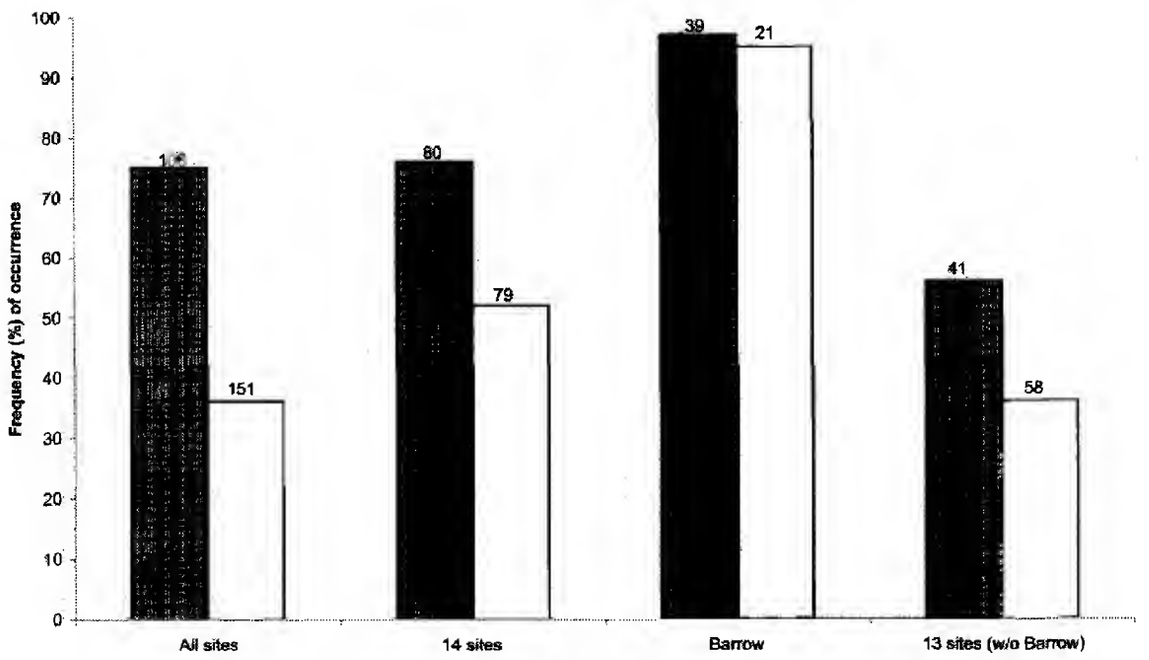


Figure 4. Percentage of site-years that Steller's Eiders were present before (shaded bars) and after (white bars) 1970 in northern Alaska. The number of site-years appears above bars.

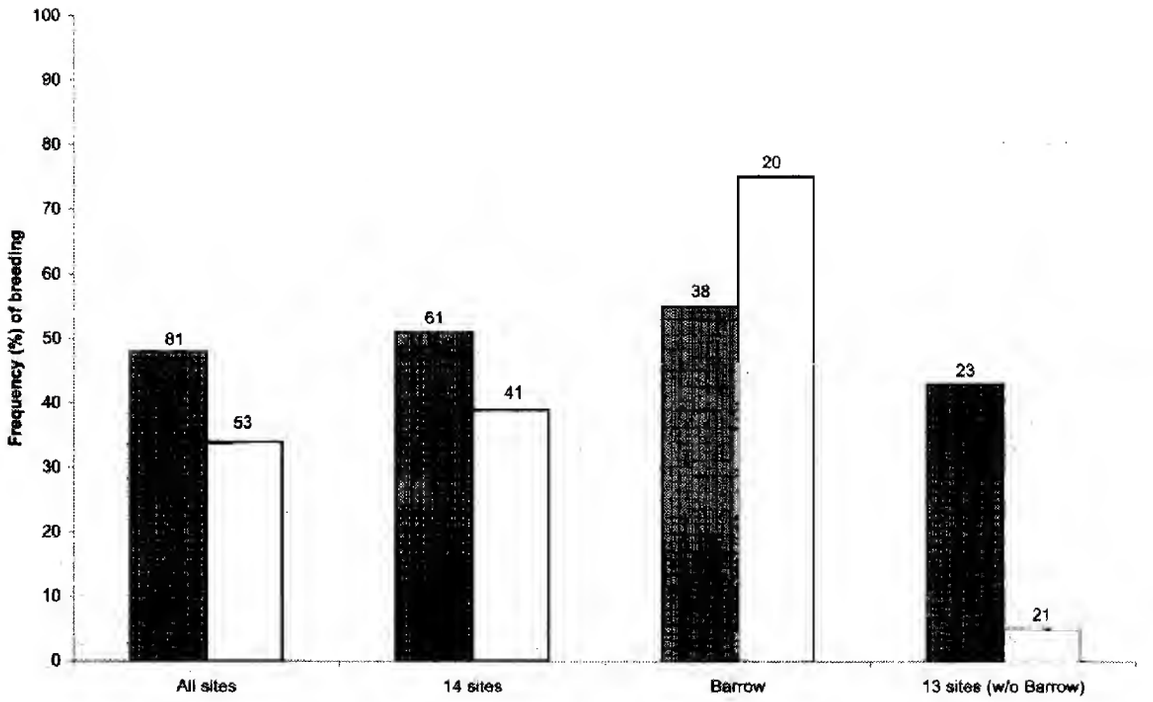


Figure 5. Percentage of site-years that Steller's Eiders were breeding when present before (shaded bars) and after (white bars) 1970 in northern Alaska. The number of site-years appears above bars.

Wainwright and the Sagavanirktok River have both historical and recent data for comparison (Table 1). These data indicate declines in occurrence (from 76% of historical to 52% of recent site-years; Figure 4) and breeding frequency (from 51% to 39%; Figure 5), as do all records east of the Sagavanirktok River. During 12 years of recent studies on the Colville River Delta, there was only one record of occurrence and no evidence of breeding.

Data on occurrence and breeding within 10 km of Barrow for 39 historical and 21 recent site-years (1881–2000), however, do not suggest declines (Figures 4 and 5). Steller's Eiders were recorded during 97% of historical and 95% of recent site-years, and they bred in 55% of historical and 70% of recent site-years (Figures 4 and 5).

If the Barrow data are omitted from the subset of sites with both historical and recent records, the frequency of occurrence still declines from 56% to 36% of site-years (Figure 4). The decline in breeding frequency, however, is much greater—from 43% to 5% (Figure 5). These data clearly indicate a reduction in both occurrence and breeding frequency for the Arctic coastal plain, except near Barrow (Figures 4 and 5).

Western Alaska

There are only four historical breeding records for the western Alaska subpopulation north of the central Yukon–Kuskokwim Delta (Figure 6). A brood of three was seen in 1879 at Port Clarence, on the Seward Peninsula (Portenko 1972, Kessel 1989), five eggs were collected from a nest at St. Michael (WFVZ), and there were two reports of nesting for St. Lawrence Island (Nelson 1887, Fay and Cade 1959); however, only the report by Fay and Cade (1959) was substantiated.

Table 1 Distribution of Steller's Eider Observations in Northern Alaska during the Breeding Season (May–September)[a]

Location[b]	Time period[c]	Total site–years[d]	Site–years present	Site–years breeding
Cape Sabine	H	4	3	0
Point Lay	R	10	0	0
Icy Cape	R	1	1	0
Wainwright[e]	H	10	7	1
	R	2	1	0
Kaolak River	H	2	0	0
Peard Bay[e]	H	1	1	0
	R	2	1	0
Barrow[e]	H	39	38	21
	R	21	20	15
Meade/Chipp Rivers[e]	H	6	2	2
	R	2	1	0
Meade River	R	2	0	0
Atqasuk[e]	H	1	1	0
	R	4	1	0
Inaru River	H	3	2	0
Meade River Delta[e]	H	2	1	0
	R	1	0	0
Admiralty Bay	H	1	1	1
Dease Inlet	H	1	1	1
Singiluk	R	1	1	0
Topagaruk River	H	1	1	1
Chipp River	H	4	4	2
Cape Simpson	H	4	2	2
Pitt Point/Lonely[e]	H	6	4	4
	R	1		0
West/East Long, Goose Lakes				
	R	5	1	0
Island Lake	R	2	1	0
Teshekpuk Lake	H	1	0	0
Square Lake	R	1	0	0
Cape Halkett[e]	H	3	3	2
	R	1	1	0
Kogru River	R	1	0	0
Colville River[e]	H	2	0	0
	R	1	1	1
Colville River Delta[e]	H	3	3	1?
	R	12	1	0
Umiat area[e]	H	4	0	0
	R	1	0	0
Anaktuvuk Pass	H	1	1	0
Milne Point	R	1	1	0
Oliktok Point	R	5	2	0
Sakonowyak River	R	3	1	0
Beechey Point	R	2	0	0
Kuparuk River Delta	R	1	0	0
Storkersen Point[e]	H	1	1	0
	R	8	4	0

(continued)

Table 1 *(Continued)*

Location[b]	Time period[c]	Total site–years[d]	Site–years present	Site–years breeding
Pt. McIntyre	R	1	0	0
Prudhoe Bay[e]	H	1	1	0
	R	21	13	1[f]
Sagavanirktok River[e]	H	1	0	0
	R	2	0	0
Franklin Bluffs	R	1	0	0
Elusive Lake	R	1	1	1[f]
Kadleroshilik River	R	2	0	0
Shaviovik River Delta	R	2	0	0
Bullen Point	R	1	0	0
Canning River Delta	R	6	0	0
Tamayariak River	R	3	0	0
Katakturuk River	R	3	0	0
Marsh Creek	R	1	0	0
Sadlerochit River	R	3	0	0
Collinson Point	H	1	1	?
Hulahula River	R	1	0	0
Okpilak River Delta	R	3	0	0
Jago Bitty	R	2	0	0
Jago River Delta	R	2	0	0
Nuguanak	R	1	0	0
Barter Island/Kaktovik	H	1	1	0
	R	1	0	0
Humphrey Point	H	1	1	0
Aichilik River Delta	R	2	0	0
Nuvagapak Point	R	1	0	0
Demarcation Point	H	1	0	0
Totals	H	106	80	39
	R	151	54	18
Herschel Island, Yukon	R	1	1	0
Cape Bathurst, Northwest Territories				
	H	1	1	0

[a]Surveys that failed to record Steller's Eiders are included.

[b]Arranged geographically, from west to east.

[c]H, historical (before 1970); R, recent (since 1970).

[d]A site–year reflects data for a particular location during one year.

[e]One of 14 sites with both historical and recent data.

[f]Location of flight-capable brood, origin unknown.

South of the Yukon–Kuskokwim Delta, three reports, none substantiated, suggest breeding by Steller's Eiders. Notes from Chase Litttlejohn, published by Bent (1925) and later by Gabrielson and Lincoln (1959), indicated that a few Steller's Eiders nested at Morzhovoi Bay on the Alaska Peninsula, but no evidence of nesting was provided. In 1872, Dall (1873) collected an egg reported to be from a Steller's Eider nest in Unalaska Bay. The bird collected

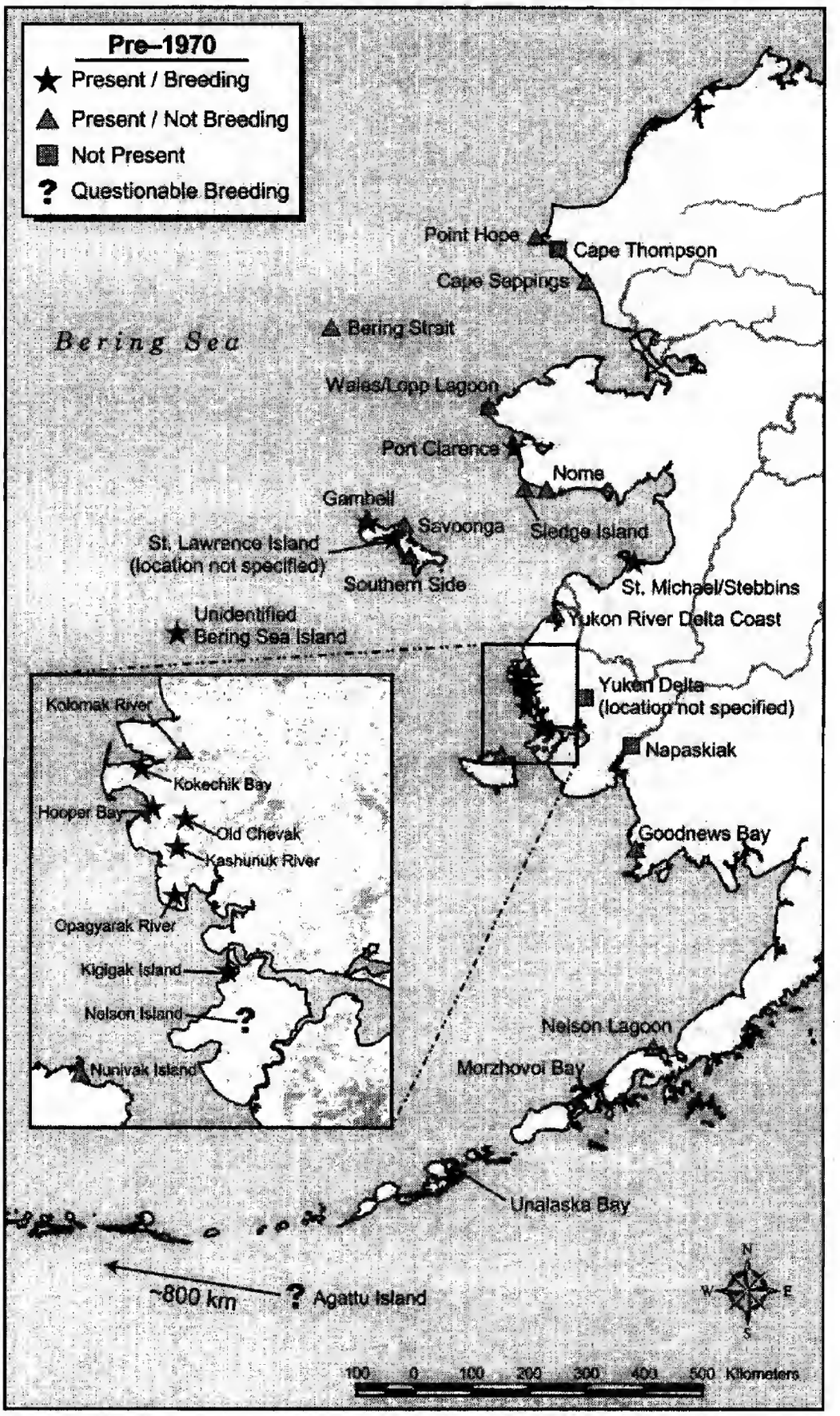


Figure 6. The occurrence and breeding distribution of Steller's Eider in western Alaska (May–September) before 1970.

with the egg, however, was an adult male Steller's Eider, although it was recorded as a female on the data card (J. Dean, National Museum of Natural History, Washington, D.C., in litt.) and was published that way (Dall 1873). The egg's dimensions are within the range of Steller's Eider eggs measured near Barrow (Quakenbush et al. 1995, Quakenbush, unpubl. data); unfortunately, so are those for 10 of 13 species of waterfowl that breed regularly in the Alaska Peninsula/eastern Aleutian Islands region (data from Bellrose 1978). Turner (1886) wrote that the species "breeds sparingly on Agattu Island," according to local Natives. Murie (1959) did not find any nesting along the Aleutian Islands, and Natives at Attu did not recognize pictures of Steller's Eiders, saying that they did not occur there, even in winter. Murie (1959) found no evidence of breeding on the Alaska Peninsula or the Aleutians in 1936 or 1937, and none has been reported since then, despite many visitors.

Although suggestive of sporadic breeding in low numbers, these records should not be regarded as conclusive evidence that Steller's Eiders were regular breeders in the Aleutians or on the Alaska Peninsula in historical times. This region includes the major wintering area for the species, and immature or nonbreeding birds could summer there. Pair formation also occurs on the wintering grounds (Metzner 1993), so courting behavior prior to migration may have suggested nesting to early observers, such as Dall and Littlejohn.

Historically, the greatest number of breeding Steller's Eiders in western Alaska occurred on the Yukon–Kuskokwim Delta, where they nested in the outer coastal zone from Kokechik Bay south to possibly Nelson Island (Conover 1926, Brandt 1943, Gabrielson and Lincoln 1959, Shepherd 1963, Kertell 1991; Figure 6). Steller's Eiders were reported (but were not breeding) as far inland as 150 miles from the coast (Gillham 1941). No historical records are available from the Yukon–Kuskokwim Delta south of Nelson Island, and historical midsummer records from Nunivak Island appear to be of Steller's Eiders that were molting, not breeding (Dau 1987).

As of 1990, Steller's Eiders were thought to have been extirpated as a breeding species from the Yukon–Kuskokwim Delta because no nests had been found there since 1975 (Kertell 1991). Between 1991 and 2000, however, six nests were found (Flint and Herzog 1999; M. Herzog, Univ. of Alaska, Fairbanks, pers. comm.), indicating that Steller's Eiders continue to nest there in extremely low numbers. The recent nesting distribution appears to be restricted to the Kashunuk, Tutakoke, and Opagyarak rivers of the central portion of the delta (Table 2, Figure 7; Kertell 1991, Flint and Herzog 1999, C. J. Lensink in litt.). Although the species nested historically at Kokechik Bay, it now occurs there only rarely and has not been seen nesting since 1969 (Table 2; Kertell 1991). No recent data are available to determine whether Steller's Eiders breed south of Nelson Island. Away from the Yukon–Kuskokwim Delta, recent surveys for nesting Spectacled Eiders (*Somateria fischeri*) on St. Lawrence Island recorded many Steller's Eiders but no evidence of breeding (S. Stephenson, USFWS, Anchorage, pers. comm.).

Overall in western Alaska, Steller's Eiders were recorded during 80% of historical site-years but only 47% of recent site-years (Figure 8). During years

Table 2 Distribution of Steller's Eider Observations in Western Alaska during the Breeding Season (May–September)[a]

Location[b]	Time period[c]	Total site–years[d]	Site–years present	Site–years breeding
Cape Lisburne	R	2	0	0
Point Hope	H	1	1	0
Cape Seppings	H	2	2	0
Cape Thompson	H	2	0	0
	R	2	1	0
Cape Krusenstern	R	2	0	0
Kotzebue	R	1	0	0
Bering Strait	H	1	1	0
Wales/Lopp Lagoon	H	11	11	0
	R	1	0	0
Tin City	R	1	0	0
Nome	H	3	3	0
Sledge Island	H	1	1	0
Port Clarence	H	1	1	1
St. Lawrence Is., general	H	3	3	1
North side	R	1	1	0
South side	H	2	1	0
	R	1	1	0
Gambell	H	15	14	1
	R	1	1	0
Savoonga	H	3	3	0
Yukon Delta coast	H	2	2	0
Yukon–Kuskokwim, general				
	H	2	1	0
St. Michaels/Stebbins	H	1	1	1
	R	3	1	0
Kolomak River	H	5	3	0
Kokechik Bay[e]	H	2	2	2
	R	11	1	0
Hooper Bay	H	2	2	2
Chevak	R	1	1	0
Keoklevik River	R	1	1	0
Old Chevak[e]	H	2	1	1
	R	3	3	0
Kashunuk River[e]	H	12	8	5
	R	18	10	3
Punoarat Point	R	2	2	0
Tutakoke River	R	15	9	2
Opagyarak River[e]	H	1	1	1
	R	11	5	2
Anerkochik River	R	8	1	0
Naskonat Peninsula	R	1	1	0
Kigigak Island	H	1	1	1[f]
	R	8	5	0
Nelson Island	H	2	1	1[f]
Napakiak area	H	2	0	0
Nunivak Island	H	2	2	0

(continued)

Table 2 *(Continued)*

Location[b]	Time period[c]	Total site–years[d]	Site–years present	Site–years breeding
Goodnews Bay	H	1	1	0
Unknown Bering Sea island	H	1	1	1
Nelson Lagoon	H	1	1	0
Morzhovoi Bay	H	1	1	1[f]
Aleutian Islands, general	H	3	0	0
Unalaska Island	H	1	1	1[g]
Umnak Island	R	1	1	0
Agattu Island	H	1	1	1[f]
Totals	H	90	72	21
	R	95	45	7

[a]Surveys that failed to record Steller's Eiders are included.

[b]Arranged geographically, from north to south.

[c]H, historical (before 1970); R, recent (since 1970).

[d]A site–year reflects data for a particular location during one year.

[e]One of four sites with both historical and recent data.

[f]Nesting reported at this location without substantiation.

[g]Possible misidentification of the one egg found at this location (see text).

when they were present, breeding frequency declined from 29% of historical site-years to 16% of recent ones (Figure 9). In the core of the species' western Alaska breeding range on the central Yukon–Kuskokwim Delta from Kokechik Bay to Nelson Island (excluding Nunivak Island), the data also indicate that Steller's Eiders were recorded more frequently before 1970 (70% of site-years) than more recently (49%; Figure 9). During years of occurrence, breeding frequency declined, from 68% of historical site-years to 18% of recent ones (Figure 9). Data from four sites with historical and recent records (Kokechik Bay, Old Chevak, Kashunuk River, and Opagyarak River; Table 2) also indicate declines in occurrence and breeding frequency (Figures 8 and 9), suggesting that the recent declines are not caused by greater numbers of samples from unoccupied or marginal habitat.

DISCUSSION

Breeding Season Distribution and Breeding Frequency

This comparison of historical and recent sightings of Steller's Eiders demonstrates a reduction in the breeding-season distribution of this species in northern Alaska. Apparently, it formerly occurred regularly to the Alaska–Canada border, and possibly into northwestern Canada. Currently, it occurs only as far east as the Sagavanirktok River. Historical and recent nesting records of Steller's Eiders in northern Alaska, however, do not indicate a contraction of the breeding range. The northwestern Arctic coastal plain,

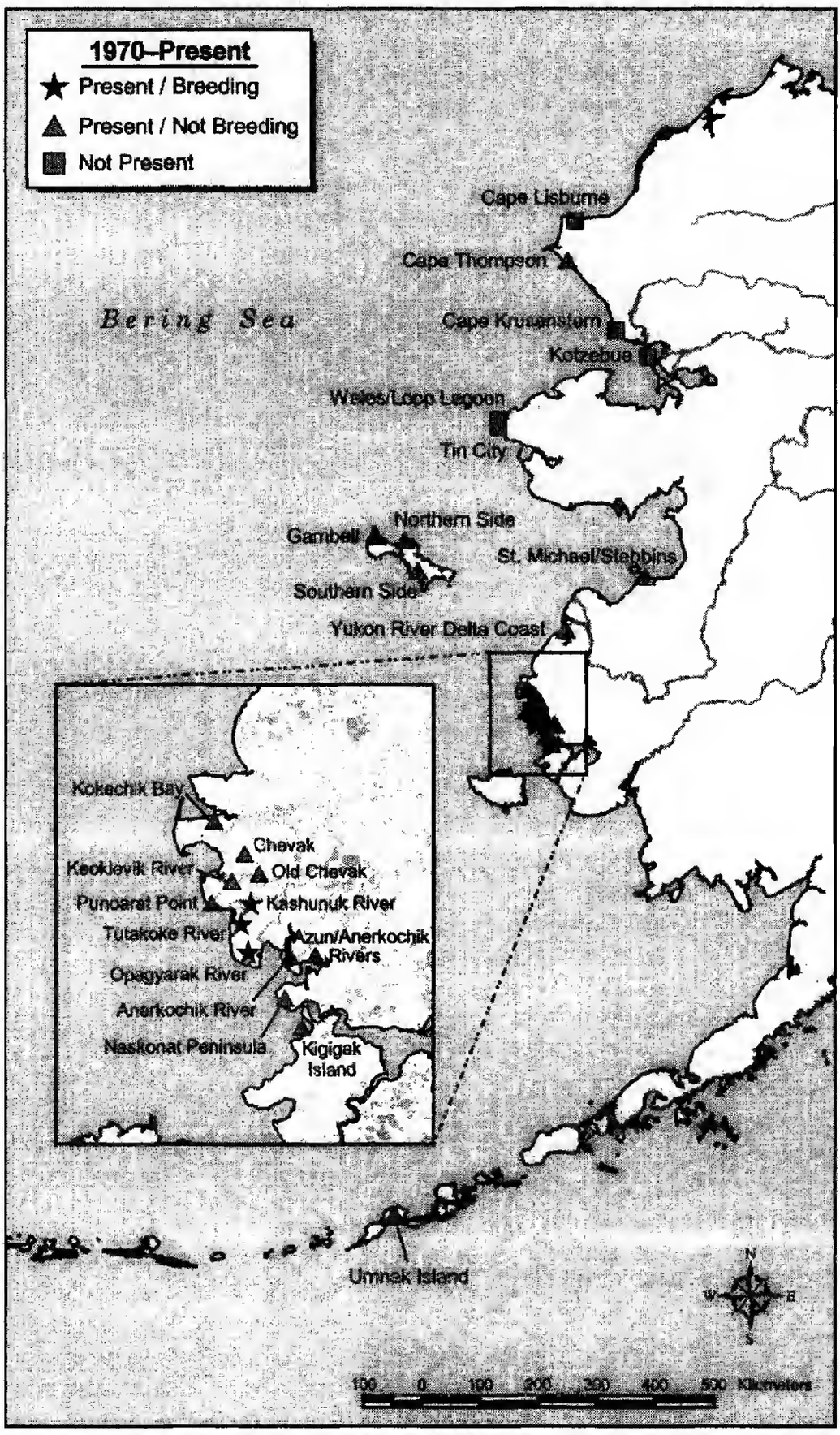


Figure 7. The occurrence and breeding distribution of Steller's Eider in western Alaska (May–September) since 1970.

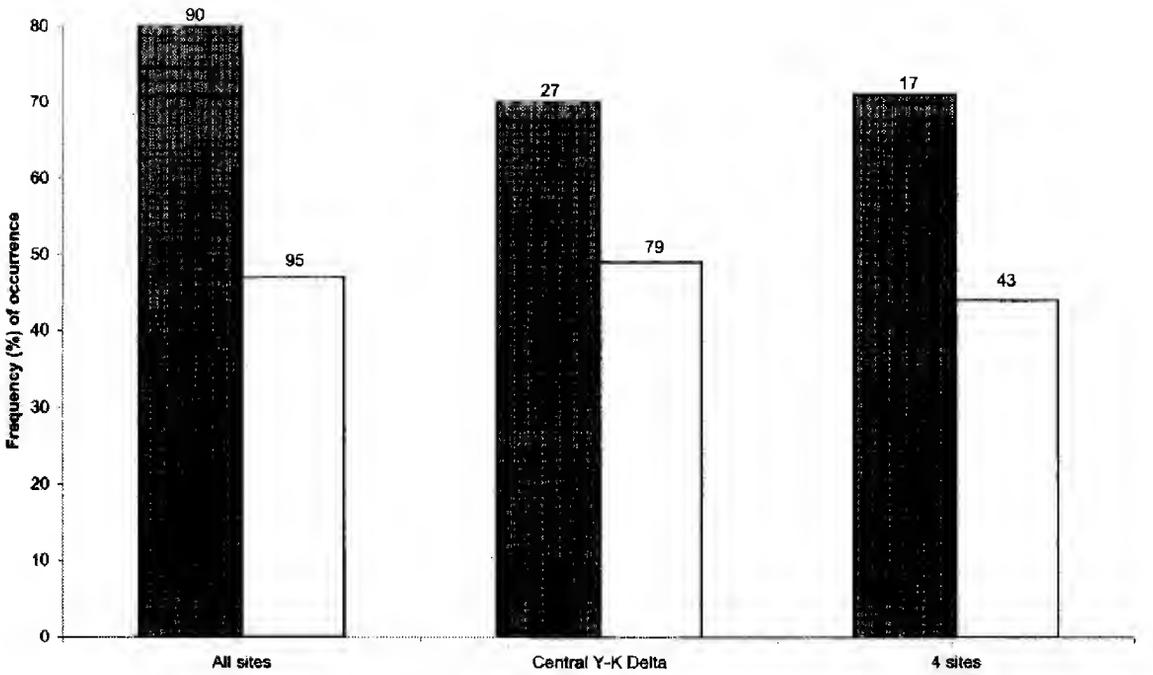


Figure 8. Percentage of site-years that Steller's Eiders were present before (shaded bars) and since (white bars) 1970 in western Alaska. The number of site-years appears above bars.

especially the Barrow area, remains the primary nesting area for Steller's Eiders, and historical records do not reflect a broader breeding distribution. Oral accounts, however, suggest that breeding was regular farther east at the Colville River Delta and near Kaktovik. Breeding frequency has decreased east of Barrow from Admiralty Bay and its drainages to the Colville River. In

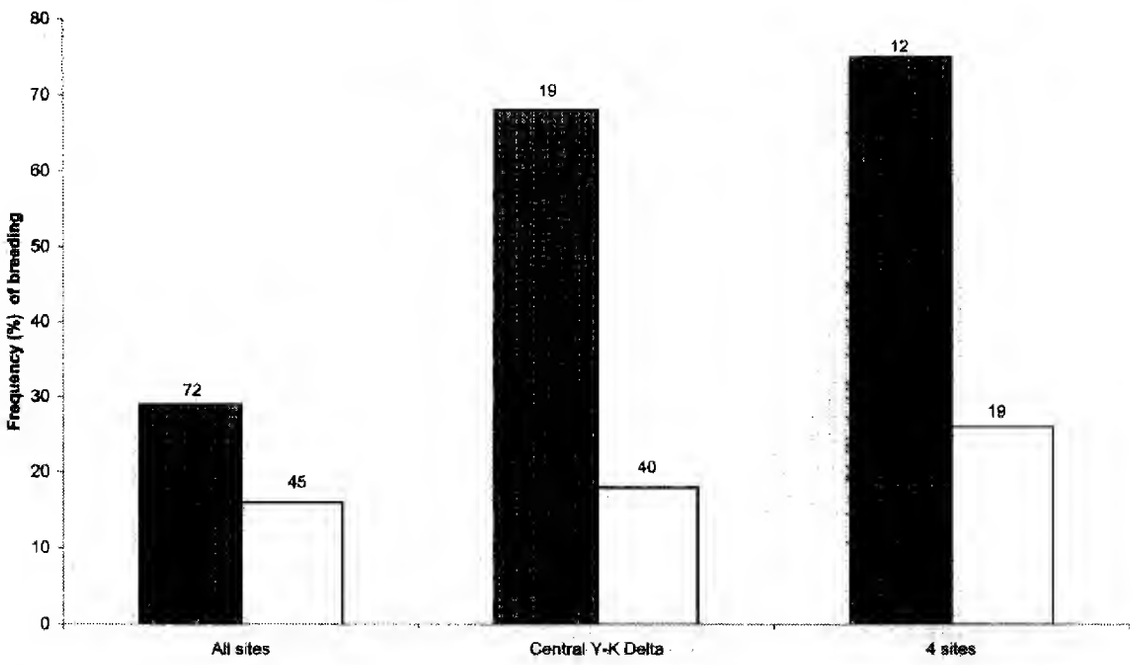


Figure 9. Percentage of site-years that Steller's Eiders were breeding when present before (shaded bars) and after (white bars) 1970 in western Alaska. The number of site-years appears above bars.

contrast, occurrence and breeding frequency at Barrow, the most important nesting area for the species, are stable or increasing.

We found that, in historical times, Steller's Eiders probably did not nest regularly in western Alaska outside of the central Yukon–Kuskokwim Delta. Both occurrence and breeding frequency on the Yukon–Kuskokwim Delta have decreased since 1970, but nesting continues there in low numbers (Flint and Herzog 1999), *contra* Kertell (1991). We believe that nesting on the Seward Peninsula and St. Lawrence Island was sporadic and no longer occurs there. We also believe that nesting may have been occasional in the Aleutian Islands–Alaska Peninsula region but emphasize that there is no conclusive evidence.

Causes for Reduced Breeding Frequency

Causes for reductions in the breeding frequency of Steller's Eiders on the Arctic coastal plain away from Barrow are not clear. Myres (1958) noted that Native children were effective egg collectors within 16 km of Barrow. This area, however, is the one location where the frequency of occurrence has been stable and the frequency of breeding has actually increased. Hunting pressure on this species across Alaska has been minimal (Wentworth 1994, Wentworth and Seim 1996, Paige et al. 1996), and sport and subsistence hunting for Steller's Eiders has been illegal in Alaska since 1991. Habitat loss for this species across the state has also been minimal, although recent housing developments in the Barrow area have resulted in the loss of a few known nest sites.

Causes for reduction in the occurrence and breeding frequency of Steller's Eiders in western Alaska are unknown. Kertell (1991) presented an extensive list of possible reasons, none of which have been discounted. In addition, lead poisoning from ingested lead shot may be a source of mortality for Steller's Eiders in both of the Alaska subpopulations. Lead poisoning has been determined to be the cause of death in both the Spectacled and Common (*Somateria mollissima*) eiders on the Yukon–Kuskokwim Delta (Franson et al. 1995) and is suspected in the death of one Steller's Eider from near Barrow (Trust et al. 1997). On the Yukon–Kuskokwim Delta, significant numbers of Spectacled Eiders and Long-tailed Ducks (*Clangula hyemalis*) are exposed to lead during the breeding season (Flint et al. 1997), and female eiders exposed to lead survive at lower rates than unexposed females do (Grand et al. 1998). The slow settlement rate of lead shot in tundra wetlands suggests that lead will remain accessible to feeding eiders for many years (Flint 1998).

Possible increases in numbers of predators such as Arctic Foxes (*Alopex lagopus*), Glaucous Gulls (*Larus hyperboreus*), and Common Ravens (*Corvus corax*) across the Arctic coastal plain have become a concern as anthropogenic food sources have become more available with increased community and industrial development (Day 1998). An increase in predator numbers or distribution may have decreased the survival and/or productivity of Steller's Eiders; on the Yukon–Kuskokwim Delta, the removal of Arctic Foxes has been shown to increase the nesting success of Brant (*Branta bernicla*; Anthony et al. 1991).

The breeding frequency of Steller's Eiders also may be affected by cycles in small-mammal populations, as has been seen elsewhere for arctic nesting birds (e.g., Pehrsson 1986, Summers 1986, Underhill et al. 1993, van Impe 1996, Spaans et al. 1998, Summers et al. 1998, Sittler et al. 2000). Between 1991 and 2001, Steller's Eiders studied near Barrow nested only in years when Brown Lemmings (*Lemmus trimucronatus*) and/or Collared Lemmings (*Dicrostonyx groenlandicus*) were abundant: 1991, 1993, 1995, 1996, 1999, and 2000 (Quakenbush and Suydam 1999, Obritschkewitsch et al. 2001). Between 1975 and 1980, other studies near Barrow found a similar pattern of irregular breeding that corresponded with years of lemming abundance (Quakenbush and Suydam 1999). Pomarine Jaegers (*Stercorarius pomarinus*) and Snowy Owls (*Nyctea scandiaca*) also nest at Barrow only during years of lemming abundance (Pitelka et al. 1955a, b). Evidence increasingly suggests that Steller's Eiders at Barrow nest within defended nesting territories of Pomarine Jaegers and Snowy Owls and benefit from their protection against predation by Arctic Foxes (Quakenbush and Suydam 1999). The Barrow area is well known for population cycles of Brown Lemmings that are more frequent and higher in amplitude than those farther south or east (Rausch 1950, Thompson 1955, Pitelka 1973, Batzli et al. 1980, Pitelka and Batzli 1993). Other areas within the Arctic coastal plain have been studied but have not shown lemming or other small-mammal cycles similar to those near Barrow (Feist 1975; Pitelka and Batzli 1993; D. Troy pers. comm.). If nesting Steller's Eiders are dependent on species of birds that defend their nests aggressively, such as the Pomarine Jaeger and Snowy Owl, for protection against Arctic Foxes, Barrow may be the most reliable place in northern Alaska for eiders to nest successfully, although not annually.

When Steller's Eider nests were found on the Yukon–Kuskokwim Delta in 1924 by Conover (1926), Snowy Owls and all three species of jaegers also were nesting. More than 40 Snowy Owl nests were found, and extremely high populations were reported for lemmings and voles (*Lemmus, Dicrostonyx, Microtus*; Brandt 1943). The Steller's Eider nest on St. Lawrence Island in 1954 was found near three Snowy Owl nests; two additional Snowy Owl nests were found approximately 13 km away, and a high in the Tundra Vole (*Microtus oeconomus*) population was reported that year (Fay and Cade 1959). Hence, the relationship between Snowy Owls and Steller's Eiders observed at Barrow may be important for western Alaska as well. Snowy Owls were formerly uncommon breeders on the Yukon–Kuskokwim Delta (Conover 1926), but they are essentially absent now (C. Dau, USFWS, Anchorage, pers. comm.). If Steller's Eiders nest with Snowy Owls and/or jaegers whenever possible, their breeding distribution and breeding frequency would be more similar to those of predatory birds (spatially unpredictable and temporally sporadic) than other waterfowl (spatially predictable and temporally regular).

Population growth in eiders and other waterfowl with similar life-history strategies appears to be sensitive to survival rates of adults (USFWS 1996, Schmutz et al. 1997). Steller's, like other eiders, tends toward late sexual maturity, high annual adult survival (90%; Flint et al. 2000), longevity (20+

years; Dunning 1997), and low productivity in most years (Quakenbush and Suydam 1999, Quakenbush unpubl. data).

With our current state of knowledge, efforts to aid the conservation of the Alaska breeding population of Steller's Eiders should focus on factors that maintain high adult survival and increase productivity and survival to maturity. Further investigation of the relationship among Steller's Eiders, Snowy Owls, and jaegers may better our understanding of the eider's breeding distribution, breeding frequency, and productivity and may provide insights for its recovery.

ACKNOWLEDGMENTS

Numerous USFWS and U.S. Geological Survey/Biological Resources Division personnel and other researchers provided unpublished data. Much of this work was conducted for the USFWS while the first three authors were writing the draft recovery plan for Steller's Eider. Data provided by the curators of the collections of the Denver Museum of Natural History, the Western Foundation of Vertebrate Zoology, and Cornell University, Ithaca, New York, contributed greatly to documentation of the historical distribution. Daniel Gibson of the University of Alaska Museum provided information on Alaska specimens from several collections. Will Lentz, Allison Zusi-Cobb, and Tai Graham of ABR, Inc., produced the map figures. An early draft of the manuscript benefited from reviews by Christian Dau, Robert Suydam, Paul Flint, and Lynn Dickson; comments from Christian Dau improved a later version as well.

LITERATURE CITED

Anderson, R. M. 1913. Report on the natural history collections of the expedition, in My Life with the Eskimos (V. Stefansson, ed.), pp. 436–527. MacMillan, New York.

Anthony, R. M., Flint, P. L., and Sedinger, J. S. 1991. Arctic Fox removal improves nest success of black Brant. Wildlife Soc. Bull. 19:176–184.

Bailey, A. M. 1925. A report on the birds of northwestern Alaska and regions adjacent to Bering Strait, part V. Condor 27:197–207.

Bailey, A. M. 1948. Birds of Arctic Alaska. Colo. Mus. Nat. Hist. Popular Ser. 8.

Bee, J. W. 1958. Birds found on the Arctic slope of northern Alaska. Univ. Kan. Publ., Mus. Nat. Hist. 10:163–211.

Bent, A. C. 1925. Life histories of North American wild fowl, part 2. U.S. Natl. Mus. Bull. 130.

Balogh, G. R., and Larned, W. W. 1994. Eider breeding population survey, Alaska Arctic coastal plain, 1994. Unpubl. report available from U.S. Fish and Wildlife Service (USFWS), 1011 East Tudor Road, Anchorage, AK 99503–6199.

Batzli, G. O., White, R. G., MacLean, S. F., Jr., Pitelka, F. A., and Collier, B. D. 1980. The herbivore-based trophic system, in An Arctic Ecosystem: The Coastal Tundra at Barrow, Alaska (J. Brown, P. C. Miller, L. L. Tieszen, and F. L. Bunnell, eds.), pp. 335–410. Dowden, Hutchinson, and Ross, Stroudsberg, PA.

Bellrose, F. C. 1978. Ducks, Geese and Swans of North America. Stackpole, Harrisburg, PA.

Boarman, W. I., and Coe, S. J. 2000. Finding value in pre-existing datasets: Ecological effects of raven populations in Joshua Tree National Park. Conservation Biology in Practice 1:32–34.

Brackney, A. W., and King, R. J. 1993. Aerial breeding pair survey of the Arctic coastal plain of Alaska: Revised estimates of waterbird abundance, 1986–1992. Unpubl. report available from USFWS, 1011 East Tudor Road, Anchorage, AK 99503–6199.

Brackney, A.W., and King, R. J. 1994. Aerial breeding pair survey of the Arctic coastal plain of Alaska, 1993. Unpubl. report available from USFWS, 1011 East Tudor Road, Anchorage, AK 99503–6199.

Brooks, W. S. 1915. Notes on birds from east Siberia and arctic Alaska. Bull. Mus. Comp. Zool. 59:361–413.

Brandt, H. 1943. Alaska Bird Trails. Bird Res. Found., Cleveland, OH.

Conover, H. B. 1926. Game birds of the Hooper Bay region, Alaska. Auk 43:162–180.

Dall, W. H. 1873. Notes on the avifauna of the Aleutian Islands, especially those west of Unalaska. Proc. Calif. Acad. Sci. (first series) 5:270–281.

Dau, C. P. 1987. Birds in nearshore waters of the Yukon–Kuskokwim Delta, Alaska. Murrelet 68:12–23.

Day, R. H. 1998. Predator populations and predation intensity on tundra-nesting birds in relation to human development. Unpubl. report available from USFWS, 1011 East Tudor Road, Anchorage, AK 99503–6199.

Dixon, J. S. 1943. Birds observed between Point Barrow and Herschel Island on the arctic coast of Alaska. Condor 45:49–57.

Dunning, J. B., Jr. (ed.). 1997. Significant encounters. N. Am. Bird Bander 22:133–138.

Fay, F. H., and Cade, T. J. 1959. An ecological analysis of the avifauna of St. Lawrence Island, Alaska. Univ. Calif. Publ. Zool. 63:73–150.

Feist, D. D. 1975. Population studies of lemmings in the coastal tundra of Prudhoe Bay, Alaska, in Biological investigations of the tundra biome in the Prudhoe Bay region, Alaska (J. Brown, ed.), pp. 135–143. Biol. Pap. Univ. Alaska, Spec. Rep. 2.

Flint, P. L. 1998. Settlement rate of lead shot in tundra wetlands. J. Wildlife Mgmt. 62:1099–1102.

Flint, P. L., and Herzog, M. P. 1999. Breeding of Steller's Eiders, *Polysticta stelleri*, on the Yukon–Kuskokwim Delta, Alaska. Can. Field-Nat. 113:1–3.

Flint, P. L., Petersen, M. R., and Grand, J. B. 1997. Exposure of Spectacled Eiders and other diving ducks to lead in western Alaska. Can. J. Zool. 75:439–443.

Flint, P. L., Petersen, M. R., Dau, C. P., Hines, J. E., and Nichols, J. D. 2000. Annual survival and site fidelity of Steller's Eiders molting along the Alaska Peninsula. J. Wildlife Mgmt. 64:261–268.

Franson, J. C., Petersen, M. R., Meteyer, C. U., and Smith, M. R. 1995. Lead poisoning of Spectacled Eiders (*Somateria fischeri*) and of a Common Eider (*Somateria mollissima*) in Alaska. J. Wildlife Diseases 31:268–271.

Gabrielson, I. N., and Lincoln, F. C. 1959. The Birds of Alaska. Stackpole, Harrisburg, PA.

Gill, R., Handel, C., and Connors, P. 1985. Bird utilization of Peard Bay and vicinity, in Environmental characterization and biological utilization of Peard Bay (P. J. Kinney, ed.), vol. 35, pp. 244–323. Environmental Assessment of the Alaskan Continental Shelf, Final Reports (Biological Studies) (available from Minerals Management Service, 949 E. 36th Ave., Room 300, Anchorage, AK 99508-4363).

Gillham, C. E. 1941. Report of Alaska wildfowl investigations, summer, 1941, lower Yukon River, Chevak, Hooper Bay. Unpubl. report available from USFWS, 1011 East Tudor Road, Anchorage, AK 99503–6199.

Grand, J. B., Flint, P. L., Petersen, M. R., and Moran, C. L. 1998. Effect of lead poisoning on Spectacled Eider survival rates. J. Wildlife Mgmt. 62:1103–1109.

Kertell, K. 1991. Disappearance of the Steller's Eider from the Yukon–Kuskokwim Delta, Alaska. Arctic 44:177–187.

Kessel, B. 1989. Birds of the Seward Peninsula, Alaska: Their Biogeography, Seasonality, and Natural History. Univ. of Alaska Press, Fairbanks.

King, R. J., and Brackney, A. W. 1995. Expanded aerial searches for Steller's Eider on the Arctic coastal plain, June 29–July 3, 1995. Unpubl. report available from USFWS, 1011 East Tudor Road, Anchorage, AK 99503–6199.

King, R. J., and Dau, C. P. 1997. Expanded aerial searches for Steller's Eiders on the Arctic coastal plain of Alaska, 1997. Unpubl. report available from USFWS, 1011 East Tudor Road, Anchorage, AK 99503–6199.

Larned, W. W., and Balogh, G. R. 1994. Eider breeding population survey, Alaska Arctic coastal plain, 1993. Unpubl. report available from USFWS, 1011 East Tudor Road, Anchorage, AK 99503–6199.

Larned, W. W., Balogh, G. R., Stehn, R. A., and Butler, W. I. 1993. The status of eider breeding populations in Alaska, 1992. Unpubl. report available from USFWS, 1011 East Tudor Road, Anchorage, AK 99503–6199.

Metzner, K. A. 1993. Ecological strategies and wintering Steller's Eiders on Izembek Lagoon and Cold Bay, Alaska. M.S. thesis, Univ. Mo., Columbia.

Murie, O. J. 1959. Fauna of the Aleutian Islands and Alaska Peninsula. N. Am. Fauna 61.

Myres, M. T. 1958. Preliminary studies of the behavior, migration, and distributional ecology of eider ducks in northern Alaska, 1958. Unpubl. interim progress report prepared for Arctic Institute of North America, Fairbanks, AK, by University of British Columbia, Vancouver, BC (available from AINA, Univ. Calgary, 2500 University Dr. NW, Calgary, Alberta T2N 1N4, Canada).

Nelson, E. W. 1887. Birds of Alaska, in Report on natural history collections made in Alaska between the years 1877 and 1881 (H. W. Henshaw, ed.), pp. 19–226. Government Printing Office, Washington, D.C.

Nygård, T., Frantzen, B., and Švažas, S. 1995. Steller's Eiders *Polysticta stelleri* wintering in Europe: Numbers, distribution and origin. Wildlfowl 46:140–155.

Obritschkewitsch, T., Martin, P. D., and Suydam, R. S. 2001. Breeding biology of Steller's Eiders nesting near Barrow, Alaska, 1999–2000. Ecological Services Fairbanks, AK, U.S. Fish and Wildlife Service, Tech. Rep. NAES-TR-01-04 (available from USFWS, 1011 East Tudor Road, Anchorage, AK 99503–6199).

Paige, A. W., Scott, C. L., Andersen, D. B., Georgette, S., and White, R. J. 1996. Subsistence use of birds in the Bering Strait region, Alaska. Alaska Dept. Fish and Game, Div. of Subsistence, Tech. Pap. 239 (available from Alaska Dept. Fish and Game, P. O. Box 25526, Juneau, AK 99802-5526).

Pehrsson, O. 1986. Duckling production of the Oldsquaw in relation to spring weather and small-rodent fluctuations. Can. J. Zool. 64:1835–1841.

Pitelka, F. A. 1973. Cyclic pattern in lemming populations near Barrow, Alaska, in Alaskan Arctic Tundra (M. E. Britton, ed.), pp. 199–215. Arctic Inst. N. Am. Tech. Pap. 25.

Pitelka, F. A. 1974. An avifaunal review for the Barrow region and North Slope of arctic Alaska. Arctic and Alpine Res. 6:161–184.

Pitelka, F. A., and Batzli, G. O. 1993. Distribution, abundance, and habitat use by lemmings on the North Slope of Alaska, in The Biology of Lemmings (N. C. Stenseth and R. A. Ims, eds.), pp. 213–236. Academic Press, London.

Pitelka, F. A., Tomich, P. Q., and Treichel, G. W. 1955a. Breeding behavior of jaegers and owls near Barrow, Alaska. Condor 57:3–18.

Pitelka, F. A., Tomich, P. Q., and Treichel, G. W. 1955b. Ecological relations of jaegers and owls as lemming predators near Barrow, Alaska. Ecol. Monogr. 25:85–117.

Portenko, L. A. 1972. [Birds of the Chukchi Peninsula and Wrangel Island], vol. I. Nauka, Leningrad, USSR. (Translated in 1981 by Smithsonian Institution and National Science Foundation, Washington, D.C.).

Quakenbush, L., and Cochrane, J. F. 1993. Report on the conservation status of the Steller's Eider (*Polysticta stelleri*), a candidate threatened and endangered species. Unpubl. report available from USFWS, 1011 East Tudor Road, Anchorage, AK 99503–6199.

Quakenbush, L., Suydam, R., Fluetsch, K. M., and Donaldson, C. L. 1995. Breeding biology of Steller's Eiders nesting near Barrow, Alaska, 1991–1994. Unpubl. report available from USFWS, 1011 East Tudor Road, Anchorage, AK 99503–6199.

Quakenbush, L., and Suydam, R. 1999. Periodic nonbreeding of Steller's Eiders near Barrow, Alaska, with speculations on possible causes, in Behaviour and ecology of sea ducks (R. I. Goudie, M. R. Petersen, and G. J. Robertson, eds.), pp. 34–40. Can. Wildlife Service Occ. Pap. 100.

Rausch, R. 1950. Observations on a cyclic decline of lemmings (*Lemmus*) on the arctic coast of Alaska during spring of 1949. Arctic 3:166–177.

Ritchie, R. J., and King, J. G. 2001. Results of Steller's Eider surveys near Barrow, Admiralty Bay, and Meade River, Alaska, 1999 and 2000. Unpubl. report available from ABR, Inc., P. O. Box 80410, Fairbanks, AK 99708.

Schmutz, J. A., Rockwell, R. F., and Petersen, M. R. 1997. Relative effects of survival and reproduction on the population dynamics of Emperor Geese. J. Wildlife Mgmt. 61:191–201.

Sittler, B., Gilg, O., and Berg, T. R. 2000. Low abundance of King Eider nests during low lemming years in northeast Greenland. Arctic 53:53–60.

Shepherd, P. E. K. 1963. Nesting ecology of Black Brant in Alaska. Unpubl. report available from Alaska Dept. Fish and Game, P. O. Box 25526, Juneau, AK 99802-5526.

Spaans, B., Blijleven, H. J., Popov, I. U., Rykhilova, M. E., and Ebbinge, B. S. 1998. Dark-bellied Brent Geese *Branta bernicla bernicla* forego breeding when Arctic Foxes *Alopex lagopus* are present during nest initiation. Ardea 86:11–20.

Summers, R. W. 1986. Breeding production of dark-bellied Brent Geese *Branta bernicla bernicla* in relation to lemming cycles. Bird Study 33:105–108.

Summers, R. W., Underhill, L. G., and Syroechkovski, Jr., E. E. 1998. The breeding productivity of dark-bellied Brent Geese and Curlew Sandpipers in relation to changes in the number of Arctic Foxes and lemmings on the Taimyr Peninsula, Siberia. Ecography 21:573–580.

Talarico, D., and Mossop, D. 1986. Herschel Island avifauna and interpretive report 1986. Unpubl. report by Yukon Department of Renewable Resources, P. O. Box 2703, Whitehorse, Yukon Y1A 2C6, Canada.

Thompson, D. Q. 1955. The 1953 lemming emigration at Point Barrow, Alaska. Arctic 8:37–45.

Trust, K. A., Cochrane, J. F., and Stout, J. H. 1997. Environmental contaminants in three eider species from Alaska and Arctic Russia. U.S. Fish and Wildlife Service Tech. Rep. WAES-TR-97-03, available from USFWS, 1011 East Tudor Road, Anchorage, AK 99503–6199.

Turner, L. M. 1886. Contributions to the natural history of Alaska. U.S. Army Signal Service, Arctic Ser. Publ. II.

Underhill, L. G., Prys-Jones, R. P., Syroechkovski, Jr., E. E., Groen, N. M., Karpov, V., Lappo, H. G., van Roomen, M. W. J., Rybkin, A., Schekkerman, H., Spiekman, H., and Summers, R. W. 1993. Breeding of waders (Charadrii) and Brent Geese *Branta bernicla bernicla* at Pronchishcheva Lake, northeastern Taimyr, Russia, in a peak and decreasing lemming year. Ibis 135:277–292.

U.S. Fish and Wildlife Service. 1996. Spectacled Eider recovery plan (available from USFWS, 1011 East Tudor Road, Anchorage, AK 99503–6199).

Van Impe, J. 1996. Long-term reproductive performance in White-fronted Geese *Anser a. albifrons* and tundra Bean Geese *A. fabalis rossicus* wintering in Zeeland (the Netherlands). Bird Study 43:280–289.

Wentworth, C. 1994. Subsistence migratory bird harvest survey—Saint Lawrence Island: Results, 1993. Unpubl. report available from USFWS, 1011 East Tudor Road, Anchorage, AK 99503–6199.

Wentworth, C., and Seim, S. 1996. Subsistence waterfowl harvest survey—Yukon–Kuskokwim Delta: Comprehensive report, 1985–1995, results 1995. Unpubl. report available from USFWS, 1011 East Tudor Road, Anchorage, AK 99503–6199.

Accepted 17 May 2002

NOTES

FIRST RECORD OF A GREATER SHEARWATER IN ALASKA

JOHN M. PEARCE, Alaska Science Center, U.S. Geological Survey, 1011 E. Tudor Road, Anchorage, Alaska 99503

The Greater Shearwater (*Puffinus gravis*) breeds in the southern Atlantic Ocean and disperses after breeding to the North Atlantic. On 3 August 2001, I observed and photographed an unidentified shearwater (Figure 1) in the Gulf of Alaska, about 30 km off the southern coast of Montague Island (59° 50′ N, 148° 00′ W). The bird was subsequently identified as a Greater Shearwater. This observation and photographic documentation provides the first Alaska state record (D. Gibson in litt.) and one of very few records for the North Pacific (see Table 1). This is the 464th bird species to be recorded in the state of Alaska.

At the time of the sighting, several Fork-tailed Storm Petrels (*Oceanodroma furcata*) and Northern Fulmars (*Fulmarus glacialis*) were near our boat, while Sooty Shearwaters (*P. griseus*) and/or Short-tailed Shearwaters (*P. tenuirostris*) were seen in the distance. The unknown shearwater flew in, landed 50 feet away, and quickly swam to within 20 feet of the boat. It dove and swam underwater to forage, using its wings for propulsion, a common behavior among shearwaters (Burger 2001). At times, the shearwater swam directly under the boat.

Figure 1 clearly shows the bird to be a Greater Shearwater, a species that averages slightly larger than the Northern Fulmar (also shown). All other shearwater species with similar markings are smaller than Northern Fulmars. The bird was reminiscent of a Parasitic Jaeger (*Stercorarius parasiticus*) in that it had a dark cap extending below the eye and becoming faint over the nape, giving way to a nearly white neck and throat. The shearwater also had mottled light brown flanks and buffy sides. The photo also shows the bird's brown wings with paler edging, dark undertail coverts, and a long thin blackish bill.

Figure 1. Greater Shearwater with Northern Fulmar in the Gulf of Alaska, 3 August 2001.

Photo by John M. Pearce

Table 1 Sightings of Greater Shearwaters in the North Pacific

Date	Location	Record status	Citation
24 Feb 1979	Monterey Bay, California	not accepted	Erickson and Terrill (1996)
1–2 Oct 1994	Monterey Bay, California	accepted	Howell and Pyle (1997)
15 Oct 1995	Gulf of the Farallones, California	not accepted	McCaskie and San Miguel (1999)
13–15 Jan 2001	Monterey Bay, California	pending[a]	*Winging It*, Jan 2001
3 Aug 2001	Montague Island, Gulf of Alaska	accepted	this paper
8 Oct 2001	Santa Cruz, California	pending[a]	*Winging It*, Nov 2001

[a]Under review by California Bird Records Committee (G. McCaskie pers. comm.).

Greater Shearwaters have been reported five times off the Pacific coast of California (Table 1) and once off extreme southern Chile (Harrison 1983). No records are known from pelagic surveys conducted on the high seas of the Pacific (A. Jaramillo pers. comm.). The latitude of the Alaska observation (60° N) is not atypical for a Greater Shearwater in early August. Nearly all of the world's Greater Shearwaters spend the austral winter in the North Atlantic between 45° and 51° N latitude (del Hoyo 1992, Huettman and Diamond 2000) after dispersing from South Atlantic breeding colonies on the islands of Tristan da Cunha. Small numbers of nesting birds (<15 pairs) have also been observed on Kidney Island in the Falklands since the 1960s (Woods 1988). On the basis of molting birds in the area, Watson (1971) suggested that an undiscovered breeding colony may exist around Tierra del Fuego.

Thanks to my lovely wife Elizabeth and her father Whip Manning for the memorable boat ride. T. Van Pelt, J. Piatt, R. Gill Jr., T. Tobish, N. Senner, D. Gibson, and D. Christian assisted with identification of the bird as *P. gravis*. R. Gill, Jr., T. Tobish, D. Derksen, N. Senner, D. Ruthrauff, T. Van Pelt, and R. A. Hamilton provided editorial assistance.

LITERATURE CITED

Burger, A. E. 2001. Diving depths of shearwaters. Auk 118:755–759.

Del Hoyo, J., Elliott, A., and Sargatal, J. (eds.). 1992. Handbook of Birds of the World, vol.1. Lynx Edicions, Barcelona.

Erickson, R. A., and Terrill, S. B. 1996. Nineteenth report of the California Bird Records Committee: 1993 records. W. Birds 27:93–126.

Harrison, P. 1983. Seabirds, An Identification Guide. Houghton Mifflin, Boston.

Howell, S. N. G., and Pyle, P. 1997. Twentieth report of the California Bird Records Committee: 1994 records. W. Birds 28:117–141.

Huettman, F., and Diamond, A. W. 2000. Seabird migration in the Canadian northwest Atlantic Ocean: Moulting locations and movement patterns of immature birds. Can. J. Zool. 78:624–647.

McCaskie, G., and San Miguel, M. 1999. Report of the California Bird Records Committee: 1996 records. W. Birds 30:57–85.

Watson, G. E. 1971. Molting Greater Shearwaters (*Puffinus gravis*) off Tierra del Fuego. Auk 88:440–442.

Woods, R. 1988. Guide to the Birds of the Falkland Islands. Anthony Nelson, Oswestry, England.

Accepted 11 March 2002

GNATCATCHER SYMPATRY NEAR SAN FELIPE, BAJA CALIFORNIA, WITH NOTES ON OTHER SPECIES

ROBERT A. HAMILTON, 34 Rivo Alto Canal, Long Beach, California 90803

STEVE N. G. HOWELL, Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach, California 94970

In a monograph concerning speciation and geographic variation in black-tailed gnatcatchers, Atwood (1988) identified three principal areas of sympatry between the California Gnatcatcher (*Polioptila californica*) and the Black-tailed Gnatcatcher (*P. melanura*); the largest of these lies in northeastern Baja California, extending north along the coast of the Gulf of California from approximately 29° N (near Bahía de los Angeles) to 30° N (near Bahía San Luis Gonzaga) and 30 km inland along the eastern base of the Sierra San Pedro Mártir to approximately 30° 50′ N, 115° 15′ W (Arroyo El Cajón). To the northeast, along the gulf coast, only *P. melanura* is known (Grinnell 1928, Wilbur 1987, Atwood 1988, Howell and Webb 1995).

On 10 May 1997 we observed single family groups of *P. californica* (pair with two fledglings) and *P. melanura* (pair with three fledglings) in a desert wash tributary to Río Las Amarillas, approximately 9 km south of San Felipe and 4 km from the coast, near the road to the San Felipe International Airport (30° 56′ N 114° 47′ W); this is approximately 45 km east of all previous records. In contrast to the surrounding creosote bush (*Larrea tridentata*) and saltbush (*Atriplex* spp.) scrub that characterizes the Colorado Desert, this wash was relatively lush, supporting numerous large shrubs and small trees, such as palo verde (*Cercidium* sp.) and tamarisk (*Tamarix* sp.). This is consistent with Atwood's (1988:11) observation that, in the drier portions of its range, the California Gnatcatcher tends to select "relatively densely vegetated areas such as occur along washes, alluvial fans, or other drainage systems." The two gnatcatcher families occupied adjacent territories within the wash, and at one point the adult males exchanged scolding calls and flew at each other, appearing to make physical contact before returning to their respective families. The California Gnatcatchers appeared consistent with *P.c. margaritae* of central Baja California, being somewhat paler than both *P. c. californica* of southern California and *P. c. atwoodi* of northwestern Baja California.

Notably, and in agreement with Wilbur (1987), we found two Gambel's (*Callipepla gambelii*) and three California (*C. californica*) quail in this same segment of wash on 10 May 1997 (cf. Patten et al. 2001).

On 22 February 1998, we briefly inspected this wash with Richard A. Erickson and found that intense rains had greatly changed its appearance, with deep deposits of woody debris holding pools of standing water. One male *P. melanura* was detected during this winter visit. Finally, on 25 March 2000, Hamilton, Erickson, Michael A. Patten, and Thomas E. Wurster inspected the wash (its tamarisk woodland habitat now largely recovered) and surrounding scrub, detecting three pairs of *P. melanura* and two pairs of *P. californica*.

Approximately 15 km south of San Felipe, near Punta Radar (30° 56′ N 114° 44′ W), the appearance of cardón (*Pachycereus pringlei*) and torote prieto (*Bursera hindsiana*) signifies a zone of transition from the Colorado to the Vizcaíno desert floristic provinces (Patten et al. 2001, Howell 2001). Nelson (1922) mapped this transition just below 29° N, near Bahía de los Angeles, and was followed by Wiggins (1980), Wilbur (1987), and Roberts (1989). Bancroft (1926) placed the transition zone well to the north, near the Colorado River mouth (approximately 31° 30′ N). During a brief stop near Punta Radar just before dusk on 25 March 2000, we detected

two flickers with obvious yellow underwings, presuming them to be Gilded Flickers (*Colaptes chrysoides brunnescens*) of the Vizcaíno Desert (cf. Patten et al. 2001). This would extend the subspecies' known range approximately 100 km north of that reported by Grinnell (1928) and further support recognition of the desert transition zone in the vicinity of Punta Radar/San Felipe. Since we could not rule out the very unlikely possibility that they were Yellow-shafted Northern Flickers (*C. auratus auratus* group), and we failed to detect flickers in this area during a subsequent visit on 2 September 2000, future observers must confirm our tentative identification.

Thanks to Richard A. Erickson for suggesting preparation of this note, and for his useful comments, to Michael A. Patten for sharing his knowledge of Baja California biogeography, to Thomas E. Wurster for assistance in the field, and to Kenneth L. Weaver and Jonathan L. Atwood for their helpful reviews.

LITERATURE CITED

Atwood, J. L. 1988. Speciation and geographic variation in Black-tailed Gnatcatchers. Ornithol. Monogr. 42.

Bancroft, G. 1926. The faunal areas of Baja California del Norte. Condor 28:209–215.

Grinnell, J. 1928. A distributional summation of the ornithology of Lower California. Univ. Calif. Publ. Zool. 32:1–300.

Howell, S. N. G., and Webb, S. 1995. A Guide to the Birds of Mexico and Northern Central America. Oxford Univ. Press, Oxford, England.

Howell, S. N. G. 2001. Regional distribution of the breeding avifauna of the Baja California Peninsula, in Birds of the Baja California Peninsula: Status, distribution, and taxonomy (R. A. Erickson and S. N. G. Howell, eds.), pp. 10–22. Am. Birding Assoc. Monogr. Field Ornithol. 3.

Nelson, E. W. 1922. Lower California and its natural resources. Mem. Natl. Acad. Sci. 16 (1).

Patten, M. A., Mellink, E., de Silva, H. G., and Wurster, T. E. 2001. Status and taxonomy of the Colorado Desert avifauna of Baja California, in Birds of the Baja California Peninsula: Status, distribution, and taxonomy (R. A. Erickson and S. N. G. Howell, eds.), pp. 29–63. Am. Birding Assoc. Monogr. Field Ornithol. 3.

Roberts, N. C. 1989. Baja California Plant Field Guide. Nat. Hist. Publ. Co., La Jolla, CA.

Wiggins, I. L. 1980. Flora of Baja California. Stanford Univ. Press, Stanford, CA.

Wilbur, S. R. 1987. Birds of Baja California. Univ. of Calif. Press, Berkeley.

Accepted 26 May 2002

BOOK REVIEW

Oregon Breeding Bird Atlas. P. R. Adamus, K. Larsen, G. Gillson, and C. R. Miller. 2001. Oregon Field Ornithologists, P. O. Box 10373, Eugene, OR 97440. CD-ROM (requirements: Macintosh or Windows PC; Netscape Navigator or Internet Explorer, version 4 or higher). $25.00.

These days, most birders and ornithologists probably have a pretty good feel for what published breeding bird atlases should look like. After all, the first North American atlas projects were conducted more than a quarter-century ago, with most states and provinces having initiated or completed one or more atlases during the past decade or so. The protocol for North American breeding bird atlases is well established and widely agreed upon, and there are fairly uniform (although not formally codified) standards for publishing any atlas. The meat and potatoes of a published atlas, of course, are the species accounts: one for each breeding bird species, with about one page of text, a black-and-white illustration, a summary table, and a range map. Atlas range maps, in particular, tend to conform to a particular protocol: the familiar checkerboard pattern of little squares in different shades that correspond to possible, probable, and confirmed breeding records.

And, now, introducing the *Oregon Breeding Bird Atlas*—a radical departure from any preexisting standards or protocols for published breeding atlases. There is no text to speak of here, and there are no black-and-white illustrations. There are maps, but unlike any you have seen before: gone are the black-and-white squares, replaced with parti-colored hexagons. There isn't even a book! This atlas is available only as a compact disk.

Two obvious questions come to mind: What are the disadvantages of publishing an electronic atlas? What are the advantages of publishing an electronic atlas? And there is a third question, especially important but easy to lose sight of, given the novel medium for the *Oregon Breeding Bird Atlas*: What is the present status of the 253 species that were confirmed as breeders during the atlas years in Oregon? I shall devote the remainder of this review to answering these three questions.

What are the disadvantages of publishing an electronic atlas? For more than a year now, I have been aware of the plans to publish the *Oregon Breeding Bird Atlas* only in an electronic medium. And, for more than a year now, I have been discussing the Oregon plans with many people in the atlasing community. Most of the concerns I have heard focus on two interrelated points: first, electronic publications are not accessible to many (most?) people; second, electronic publications are impermanent and therefore of little archival value.

The first concern may have been valid a decade ago. But it really isn't, these days. Every birder or ornithologist I know owns—and uses—a computer. The key word is "uses." Birders and ornithologists rely on computers for everything from organizing their life lists to creating molecular phylogenies. The birder or ornithologist without a computer is a *rara avis*.

The second concern has greater merit, at first glance, at least. Books last forever, most people assume, whereas electronic files can be destroyed just by staring at them too hard. Ten years ago, when most electronic files were stored on floppy disks or computer hard drives (which are, in fact, quite susceptible to damage), the problem of permanence was significant. Compact disks, in contrast, are relatively resistant to damage, and they are now widely available and inexpensive.

Of course, the *perception* of inaccessibility and impermanence of the electronic medium remains. But is the perception sufficient to diminish the success of the *Oregon Breeding Bird Atlas*? That depends on whether libraries, professional scientists, and amateur researchers are willing to be open-minded about electronic publishing.

What are the advantages of publishing an electronic atlas? The two biggest are interactivity and hypertext. When you pause to think about it, the print medium is awfully inflexible: a book doesn't really *do* anything. That's fine for a novel or some other essentially linear genre ("Once upon a time . . . and they all lived happily ever after"). But not so for most reference works, which are designed to be used by real people for real-world applications. User A may want a quick summary of the most common breeders in Harney County, user B may need to know whether there is a correlation between Hermit Warbler occurrence and local logging history, and user C may be seeking everything known about Fork-tailed Storm-Petrel occurrences in Oregon. It is possible that all of this information could be contained in a traditional atlas—but not all in one place. It would be the user's job, then, to cull through the text, summarize all the data, and perform the relevant analyses. Few users ever get this far with the print medium: the approach is too cumbersome, and the original data are typically summarized in a manner that is incompatible with follow-up analyses.

Another big advantage of electronic publishing is that you can get an awful lot of data on a single disk. The *Oregon Breeding Bird Atlas* is almost 400 megabytes, but it is only one centimeter thick—and most of that is taken up by the plastic casing for the disk. Because you can get so much onto a compact disk, the *Oregon Breeding Bird Atlas* presents a more detailed analysis of habitat data than I have seen in any other atlas. It contains an immense amount of data from the North American Breeding Bird Survey (BBS), and it even includes the complete results of an earlier atlas project (for Lane County). The wants and needs of our hypothetical users A, B, and C are just a click away.

The third advantage to electronic publishing, as I see it, is sort of ironic. I refer to the advantage of permanence and accessibility. These days, when I need information on, say, range expansion in the Barred Owl, I go straight to the computer. I check out resources such as google.com, or on-line BBS data, or the *Oregon Breeding Bird Atlas*. Even if I could find my local library, I wouldn't necessarily know where to start looking for resources on range expansion in the Barred Owl. And even if I did, the book would probably be checked out or mis-shelved.

What is the present status of the 253 species that were confirmed as breeders during the atlas years in Oregon? Or, put another way, does the *Oregon Breeding Bird Atlas* succeed at summarizing patterns of occurrence, distribution, and abundance for each of the state's breeding bird species? In particular, does the *Oregon Breeding Bird Atlas* succeed as an electronic publication? To be fair, I realize that the preceding question was not necessarily the prime motivating factor for the *Oregon Breeding Bird Atlas*. But, like it or not, the most important influence of the *Oregon Breeding Bird Atlas* may well be the precedent that it establishes for electronic publishing of major ornithological reference works.

Using the *Oregon Breeding Bird Atlas* is as simple as inserting a compact disk into the correct drive. The front page simply appears on your computer screen, as soon as the disk drive is closed. What pops up in the first window is the table of contents, the introduction, and an abbreviated index. Like most atlas aficionados, I suspect, I bypassed the introduction and went straight to the species accounts. Right away, I got a list of the 275 species encountered during the atlas years. And I got something that I have never seen in any other atlas: the option to browse in phylogenetic order (as in most atlases), in alphabetical order (likely quite useful to non-ornithologist managers or biologists), or in order of confirmation rate (i. e., percentage of hexagons with confirmed breeders). It would have taken literally three times the number of pages in a printed atlas to accomplish what the Oregon atlas accomplishes with two clicks of the mouse.

Let's now check out an actual species account. We'll start with the Veery. The result: two maps (one emphasizing occurrence data, the other emphasizing possible breeding habitat), a figure showing the temporal distribution of confirmed breeding

dates, a color photograph, and a very sparse text (81 words total, much of it subject headings and statistics; it is more like a figure or table, really, than main text). So far, so good. Next, things get a little more complicated. For example, the first map shows six records for confirmed breeding, while the accompanying figure shows only one. Clicking on "field observations" doesn't help resolve the difference: there are six records of confirmed breeding, three of which have dates (1 July 1999, 8 July 1999, and 22 July 1999), three of which do not. I have to say, my exploration of the Veery account left me a little confused. There's a silver lining in the cloud, though: all of the data appear to be summarized under "field observations." If I really wanted to get to the bottom of things, I have all the data at my fingertips. This is a major advance for users of breeding bird atlases.

In addition to the species accounts, there is a large amount of introductory and ancillary material—quite a bit more than in any published atlas of which I'm aware. All of it was interesting, and most of it seemed quite useful ("interesting" and "useful" are not necessarily the same thing). Of particular interest and usefulness was an interactive overlay of all Oregon BBS routes on the atlas hexagon grid. It is conceivable that this sort of resource will encourage wildlife managers to start thinking integratively about avian monitoring. And if this comes to pass, it will be a *really* major advance for users of breeding bird atlases.

In the meantime, the *Oregon Breeding Bird Atlas* is at least as good as any of its predecessors. The status and distribution of the Veery are clearly depicted on high-quality maps. (It's only when you start to dig deeper that things get messier.) Same thing with the Chestnut-backed Chickadee (like the Veery, found in the northeast; unlike the Veery, widespread in the west). The Black-billed Magpie and Hutton's Vireo? Their ranges are basically photographic negatives of one another. Snowy Egret? The range is disjunct, with most occurrences in the southeastern deserts. And so on, and so on.

No question about it, the *Oregon Breeding Bird Atlas* succeeds at summarizing the occurrence and distribution of the state's breeding avifauna. That alone is a breakthrough for a state with more habitats and more breeding bird species than almost anywhere else in North America. What is more exciting, though, is the truly new course that the *Oregon Breeding Bird Atlas* has charted for future breeding bird atlases.

Ted Floyd

FEATURED PHOTO

RED-NAPED AND RED-BREASTED SAPSUCKERS

ROBERT A. HAMILTON, 34 Rivo Alto Canal, Long Beach, California 90803
JON L. DUNN, RR 2, Box 52R, Bishop, California 93514

The classification of the Yellow-bellied (*Sphyrapicus varius*), Red-naped (*S. nuchalis*), and Red-breasted (*S. ruber*) sapsuckers has confounded ornithologists since the late 1800s, a situation that spurred prodigious field and laboratory research during the past half-century aimed at elucidating relationships between these closely related taxa. The American Ornithologists' Union has recognized these three as species since 1985, citing the findings and conclusions of Johnson and Zink (1983). Here we consider relationships between *nuchalis* and *ruber*, sister species that are—intuition aside—more closely related to each other than either is to *varius* (Johnson and Zink 1983, Cicero and Johnson 1995). In addition to the scientific literature touched upon in this brief review, useful identification resources and overviews include Devillers (1970), DeBenedictis (1970), Dunn (1978), Kaufmann (1990), Lehman (1991), Pyle (1997), and Sibley (2000).

The Red-naped Sapsucker breeds in the Rocky Mountains, the eastern Cascades, and mountains of the Great Basin. The Red-breasted Sapsucker's northern subspecies, *S. r. ruber*, breeds from southeastern Alaska to southern Oregon, and apparently interbreeds extensively with southern *S. r. daggetti* in extreme southwestern Oregon and extreme northwestern California (Howell 1952). The breeding range of *S. r. daggetti* extends south to Marin County, across to northeastern California and south-central Oregon, and down through the Sierra Nevada, recurring in the high mountains of southern California (American Ornithologists' Union 1957, 1988).

The border between *S. r. ruber* and *S. nuchalis* traces the peaks of the Cascade Range north to central British Columbia, and mixing of these taxa "appears to be extremely scarce" (Howell 1952:268). Contact zones for *S. r. daggetti* and *S. nuchalis* have proven to be rather dynamic over the past century (Scott et al. 1976, Johnson and Johnson 1985), with two main zones of sympatry currently recognized. One encompasses parts of Modoc County, California, and adjacent Lake and Klamath counties, Oregon (Howell 1952). Examining 145 pairs in this area, Johnson and Johnson (1985) concluded that 18% of the studied pairs included at least one backcrossed individual, with interspecific breeding accounting for another 6%. The second zone of sympatry includes parts of eastern Mono County, California, and adjacent Lyon and Mineral counties, Nevada (Johnson and Johnson 1985), an area where interbreeding is "apparently very slight" (Howell 1952:251). At five additional known sites, *nuchalis* and *daggetti* are considered "essentially allopatric" by reason of one taxon being common and the other rare (Johnson and Johnson 1985). Otherwise, the Sierra Nevada is *daggetti* country, while *nuchalis* claims the Great Basin and Rockies; hybridization occurs in the areas of allopatry but is considered rare (Howell 1952; Johnson and Johnson 1985).

Both Red-breasted and Red-naped sapsuckers undergo prebasic molts on the breeding grounds. First-year Red-breasteds typically complete this molt by September, occasionally retaining some juvenal body feathers through December, and first-year Red-napeds are about a month behind this schedule (Pyle 1997). Feathers of the lower throat appear to be the last to be replaced in both species (Howell 1952). Thus, birds seen in migration should be in fresh plumage (or mostly so). This is an important consideration, since the middle and basal portions of the head and chest feathers of all *daggetti* possess melanin pigment (Howell 1952), and wearing away of red feather tips normally reveals "an underlying 'shadow' that is reminiscent of the melanistic

breast band, cheek patch, and head stripes seen so vividly in *nuchalis*" (Johnson and Johnson 1985:4). The latter authors developed a 13-step "hybrid series index" that progresses from extreme *daggetti* (score 0) to extreme *nuchalis* (score 12), illustrating even "pure" *daggetti* with conspicuous black splotches on the upper breast; this apparently reflects the birds' appearance in summer, when body and head feathers are subject to considerable wear from attending to the nest and young. Note that Kaufman (1990) highlighted such blotches as an important feature of intermediate plumages, apparently because fall and winter Red-breasted Sapsuckers normally have unmarked red breasts.

Red-naped Sapsuckers winter in the southwestern U. S. from southern Nevada and southeastern California through central New Mexico, in western Mexico as far south as Jalisco, and throughout the Baja California peninsula (American Ornithologists' Union 1998). On the coastal slope of California, they are uncommon in San Diego County (Unitt 1984), become progressively rarer north to Santa Barbara County (Lehman 1994), and are very rare north of there to southern Oregon (American Ornithologists' Union 1998). Red-breasted Sapsuckers occupy a much smaller winter range along the Pacific slope from southeastern Alaska to northern Baja California, only occasionally straying into interior desert areas. Observers should be especially careful when identifying *daggetti* east of its normal range, as in Arizona, since many such claims involve hybrids (Rosenberg 1990, P. E. Lehman in litt.).

In mid-October 2001, while traversing White Pine and Lincoln counties in east-central Nevada, Dunn encountered approximately eight Red-naped Sapsuckers, four apparent hybrids, and no Red-breasted Sapsuckers. Observer coverage in this part of Nevada is light, but these numbers are consistent with Dunn's previous experience in the eastern deserts and the Great Basin. In the western and central parts of northern Baja California, where the normal ranges of Red-naped and Red-breasted sapsuckers overlap, the Red-naped is uncommon but outnumbers both the Red-breasted and hybrids—which are about equally rare—by ratios of about 5:1 (Erickson et al. 2001).

Dunn photographed the left-hand bird shown on the back cover of this issue on 13 October 2001 at Panamint Springs, Inyo County, California. Brian Small captured the other image during the month of October at Galileo Hill, Kern County, California. The birds' ages are uncertain, although both appear consistent with their first year. Neither is a "pure" Red-naped Sapsucker as both have too much red on their faces and show little or no trace of black frames on their throats. Unlike typical Red-breasted Sapsuckers, both birds have red pigment concentrated in the throat rather than spreading across the upper breast. Some dark feathering appears to be present below the right-hand bird's throat, with limited splotches of red below, as would be expected in an intermediate plumage, so this bird seems to be a fairly straightforward Red-naped × Red-breasted hybrid. Although the left-hand bird does not show obvious black splotching around the throat, its intermediate facial pattern and concentration of red in the throat, with only limited red below that, suggest another hybrid.

Thanks to Steve N. G. Howell and Kimball L. Garrett for assisting with the preparation of this note, and to Paul E. Lehman for his helpful review.

LITERATURE CITED

American Ornithologists' Union. 1957. Check-list of North American Birds, 5th ed. Am. Ornithol. Union, Washington, D. C.

American Ornithologists' Union. 1985. Thirty-fifth supplement to the American Ornithologists' Union Check-list of North American Birds. Auk 102.

American Ornithologists' Union. 1998. Check-list of North American Birds, 7th ed. Am. Ornithol. Union, Washington, D. C.

Cicero, C., and Johnson, N. K. 1995. Speciation in Sapsuckers *(Sphyrapicus)*: III. Mitochondrial DNA sequence divergence at the cytochrome-B locus. Auk 112:547–563.

DeBenedictis, P. 1970. Gleanings from the technical literature. Birding 11:178–181.

Devillers, P. 1970. Identification and distribution in California of the *Sphyrapicus varius* group of sapsuckers. Calif. Birds 1:47–76.

Dunn, J. 1978. The races of the Yellow-bellied Sapsucker. W. Tanager 44:7.

Erickson, R. A., Hamilton, R. A., and Howell, S. N. G. 2001. New information on migrant birds in northern and central portions of the Baja California Peninsula, including species new to Mexico, in Birds of the Baja California Peninsula: Status, Distribution, and Taxonomy (R. A. Erickson and S. N. G. Howell, eds.), pp. 112–170. Monogr. Field Ornithol. 3. Am. Birding Assoc., Colorado Springs, CO.

Howell, T. R. 1952. Natural history and differentiation in the Yellow-bellied Sapsucker (*Sphyrapicus varius*). Condor 54:237–282.

Kaufman, K. 1990. A Field Guide to Advanced Birding. Houghton Mifflin, Boston.

Johnson, N. K., and Zink, R. M. 1983. Speciation in sapsuckers (*Sphyrapicus*): I. Genetic differentiation. Auk 100:871–884.

Johnson, N. K., and Johnson, C. B. 1985. Speciation in sapsuckers (*Sphyrapicus*): II. Sympatry, hybridization, and mate preference in *Sphyrapicus ruber daggetti* and *S. nuchalis*. Auk 102:1–15.

Lehman, P. 1991. Notes on plumage variation in adult Red-naped and Red-breasted sapsuckers. Birding 12:23–26.

Lehman, P. E. 1994. The Birds of Santa Barbara County, California. Vert. Mus., Univ. Calif., Santa Barbara.

Pyle, P. 1997. Identification Guide to North American Birds, part I, Columbidae to Ploceidae. Slate Creek Press, Bolinas, CA.

Rosenberg, G. 1990. Arizona birding pitfalls, part 1: Species we take for granted. Birding 12:120–129.

Scott, D. M., Ankey, C. D., and Jarosh, C. H. 1976. Sapsucker hybridization in British Columbia: Changes in 25 years. Condor 78:253–257.

Sibley, D. A. 2000. The Sibley Guide to Birds. Knopf, New York.

Unitt, P. 1984. The birds of San Diego County. San Diego Soc. Nat. Hist. Mem. 13.

27th Annual Meeting of the Western Field Ornithologists

10–13 October 2002

The San Joaquin Wildlife Sanctuary in Irvine and Ayres Country Inn in Costa Mesa, California

Conference Information

Orange County, California, offers wonderful opportunities for birders to discover southern California resident and migrant bird species in rural, urban, suburban, and pelagic settings. The area is rich in bird life, and October will find WFO visiting during autumn migration. Bolsa Chica, Newport Back Bay, Limestone Canyon, Dripping Springs, the "gold coast," the Pacific Ocean, Starr Ranch, and urban parrot roosts are examples of the field trips that have been planned for this meeting to highlight the rich diversity of landscape zones and birds that Orange County has to offer. With sufficient interest, postmeeting trips will go to the Salton Sea and Baja California.

Activities

WFO 2002 offers a mix of half-day field trips on October 11, 12, and 13. Other planned activities include a workshop on documenting bird records, evening field trips, a banding trip for hawks or owls, a full-day pelagic trip, afternoon paper sessions, and identification panels using both slides and recorded sounds. Social activities will include a welcoming reception, barbecue at the San Joaquin Wildlife Sanctuary, the annual dinner, and evening programs.

Speakers

The featured speakers for WFO 2002 are renowned marine biologist Robert L. Pitman and our own Philip Unitt. Bob will speak on the eastern Pacific pelagic frontier at the annual dinner to be held on Saturday, October 12. Phil will speak on the surprises revealed by the five years of field work for the San Diego County bird atlas at the barbecue on Friday, October 11.

Meeting Sponsors

WFO 2002 is locally hosted and sponsored by Sea and Sage Audubon Society and co-sponsored by Los Angles Audubon Society. A number of local organizations are lending their support for this meeting.

Hotel Information

Headquarters for all conference activities will be Ayres Country Inn and Suites, 325 Bristol Street, Costa Mesa, California 92626. This is a world-class small hotel that is well located with easy airport or freeway access. Ask for Western Field Ornithologists when booking your reservations: 714-549-0300, 800-322-9992. Consider bringing the entire family. There are two pools and, for the enjoyment of nonbirding family members, free transportation to nearby sights and activities. The hotel has set aside a block of 50 double rooms for WFO at $69.00 per night for a 3-night minimum stay, if the room is booked prior to September 15, 2002. The hotel is located 5 minutes from the Orange County/John Wayne Airport and will provide free transportation from the airport for hotel guests. The conference schedule, costs, and registration forms are posted at www.wfo-cbrc.org and www.seaandsageaudubon.org.

For additional information contact robcatwaters@earthlink.net.

WESTERN BIRDS

World Wide Web site: www.wfo-cbrc.org

Quarterly Journal of Western Field Ornithologists

President: Mike San Miguel, 2132 Highland Oaks Dr., Arcadia, CA 91006; sanmigbird@aol.com

Vice-President: Daniel D. Gibson, University of Alaska Museum, 907 Yukon Dr., Fairbanks, AK 99775-6960

Treasurer/Membership Secretary: Robbie Fischer, 1359 Solano Drive, Pacifica, CA 94044; robbie22@pacbell.net

Recording Secretary: Kei Sochi, The Nature Conservancy, Western Regional Office, 2060 Broadway, Suite 230, Boulder, CO 80302; ksochi@tnc.org

Directors: Ted Floyd, Kimball L. Garrett, Daniel D. Gibson, Bob Gill, Gjon Hazard, Dave Krueper, Mike San Miguel, W. David Shuford, David Yee

Editor: Philip Unitt, San Diego Natural History Museum, P. O. Box 121390, San Diego, CA 92112-1390; birds@sdnhm.org

Associate Editors: Daniel D. Gibson, Robert A. Hamilton, Ronald R. LeValley, Tim Manolis, Kathy Molina, Mark K. Sogge

Graphics Manager: Virginia P. Johnson, 4637 Del Mar Ave., San Diego, CA 92107

Photo Editor: Peter La Tourrette, 1019 Loma Prieta Ct., Los Altos, CA 92024

Featured Photo: Robert A. Hamiltom, 34 Rivo Alto Canal, Long Beach, CA 90803

Book Reviews: Steve N. G. Howell, Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach, CA 94970

Secretary, California Bird Records Committee: Guy McCaskie, P. O. Box 275, Imperial Beach, CA 91933-0275; guymcc@pacbell.net

Chairman, California Bird Records Committee: Richard A. Erickson, LSA Associates, 1 Park Plaza, Suite 500, Irvine, CA 92614; richard.erickson@lsa-assoc.com

Membership dues, for individuals and institutions, including subscription to Western Birds: Patron, $1000.00; Life, $400 (payable in four equal annual installments); Supporting, $60 annually; Contributing, $34 annually; Family $26; Regular U.S. $22 for one year, $41 for two years, $60 for three years. Dues and contributions are tax-deductible to the extent allowed by law.

Send membership dues, changes of address, correspondence regarding missing issues, and orders for back issues and special publications to the Treasurer. Make checks payable to Western Field Ornithologists.

Back issues of Western Birds within U.S. $24 per volume, $6.00 for single issues, plus $1.00 for postage. Outside the U.S. $30 per volume, $7.50 for single issues.

The California Bird Records Committee of Western Field Ornithologists revised its 10-column Field List of California Birds in January 2000. The last list covered 606 accepted species; the new list covers 613 species. Please send orders to WFO, c/o Robbie Fischer, Treasurer, 1359 Solano Drive, Pacifica, CA 94044. California addresses please add 7.75% sales tax.

Quantity: 1–9, $1.50 each, includes shipping and handling; 10–39, $1.30 each, add $2.00 for shipping and handling; 40 or more, $1.15 each, add $4.00 for shipping and handling.

Published September 15, 2002 ISSN 0045-3897

NEW...SWAROVSKI 65 MM SPOTTING SCOPES

BIG SCOPE PERFORMANCE...JUST SMALLER AND LIGHTER.

ATS 65 scope compared to an ***average 77 or 85 MM scope size***

The new ATS and STS 65 MM spotting scopes deliver the performance you normally expect from a competitive 77 or 85 MM spotting scope, but in a much smaller and lighter package (12" long and just over 2 lbs.). It even has a close focus of 10 feet, and a 33% wider field of view than the larger scopes with similar, 20-60 zoom eyepieces.

The new 65 MM scopes even compare favorably with the weight and size of popular 60MM scopes that only have zoom eyepieces to 45X. The Swarovski scope delivers much better optical and ergonomic performance. You get all of these new features at a surprisingly affordable price, when you consider the premium quality of the Swarovski 65MM ATS 65/ATS 65 HD and STS 65/STS 65 HD Spotting Scopes.

For more information call: 800-426-3089, e-mail: info@swarovskioptik.com or visit: www.swarovskioptik.com.

SWAROVSKI
OPTIK

WITH THE EYES OF A HAWK

Swarovski Optik North America, Ltd., 2 Slater Road, Cranston, RI 02920

SWAROVSKI
OPTIK
A Proud Sponsor of Western Field Ornithologists

WESTERN BIRDS

Vol. 33, No. 3, 2002

Western Specialty:
Black-chinned Sparrow

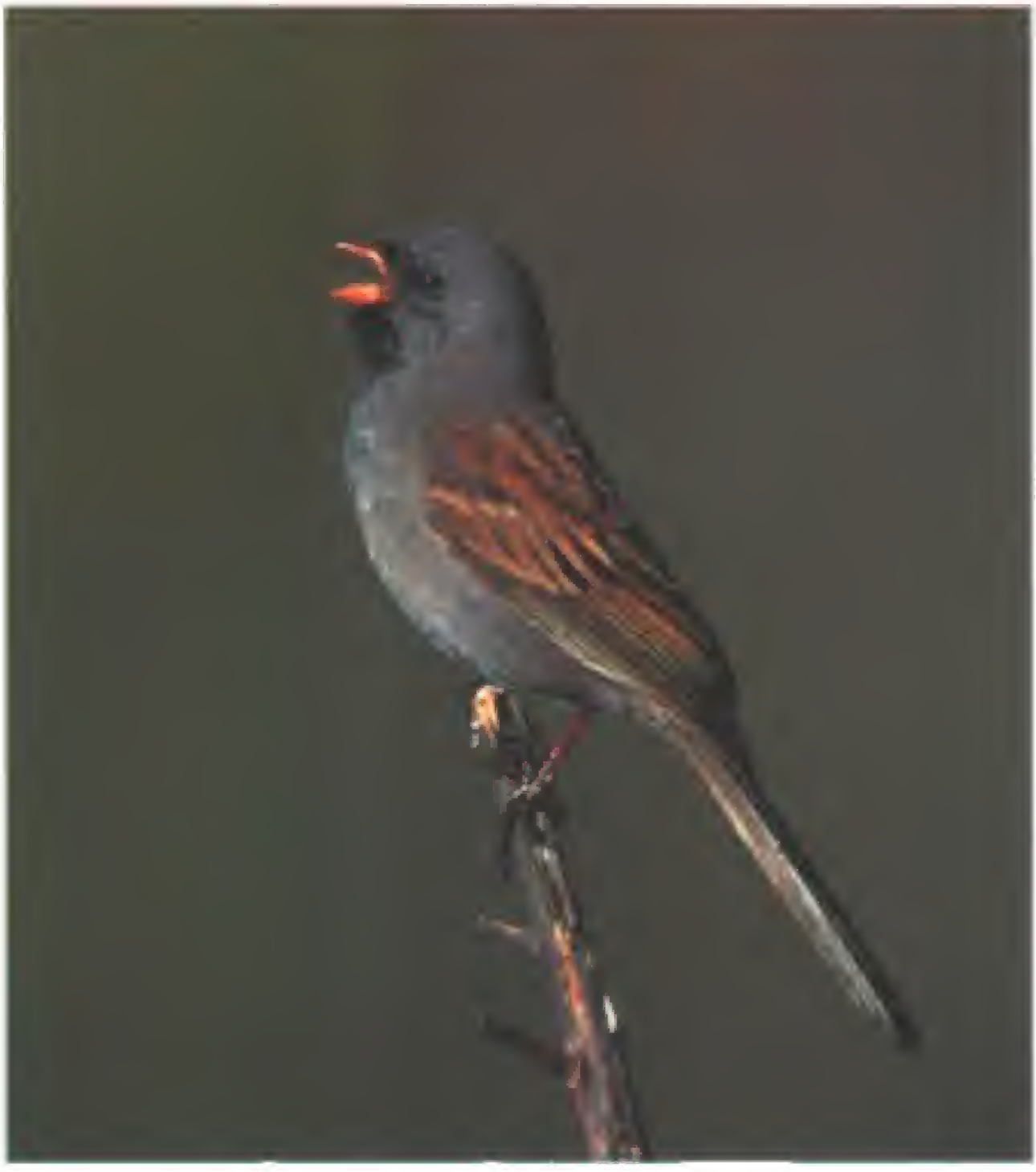


Photo by Jim Greaves of Santa Barbara, California: Black-chinned Sparrow (*Spizella atrogularis*), Simi Valley, California, April 2001.

Volume 33, Number 3, 2002

Patterns of Distribution and Abundance of Migratory Shorebirds in the Intermountain West of the United States
W. David Shuford, Gary W. Page, and Lynne E. Stenzel 134

Report of the California Bird Records Committee: 2000 Records
Tristan McKee and Richard A. Erickson 175

Abundance And Distribution of the Common Raven and American Crow in the San Francisco Bay Area, California
John P. Kelly, Katherine L. Etienne, and Jennifer E. Roth 202

Featured Photo *Steve N. G. Howell* 218

Front cover photo by © Joe Furhman of Los Angeles, California: Painted Bunting (*Passerina ciris*), Chuckwalla Mountains, Riverside County, California, April 1997. Spring sightings of male Painted Buntings in Southern California invariably cause problems for record committees, because of the difficulty of determining natural occurrence.

Back cover "Featured Photo" by © Steve N. G. Howell of Marin County, California: immature gull, Petaluma, Sonoma County, California, 27 December 2001.

Western Birds solicits papers that are both useful to and understandable by amateur field ornithologists and also contribute significantly to scientific literature. The journal welcomes contributions from both professionals and amateurs. Appropriate topics include distribution, migration, status, identification, geographic variation, conservation, behavior, ecology, population dynamics, habitat requirements, the effects of pollution, and techniques for censusing, sound recording, and photographing birds in the field. Papers of general interest will be considered regardless of their geographic origin, but particularly desired are reports of studies done in or bearing on the Rocky Mountain and Pacific states and provinces, including Alaska and Hawaii, awestern Texas, northwestern Mexico, and the northeastern Pacific Ocean.

Send manuscripts to Kathy Molina, Section of Ornithology, Natural History Museum of Los Angeles County, 900 Exposition Blvd., Los Angeles, CA 90007. For matter of style consult the Suggestions to *Contributors to Western Birds* (8 pages available at no cost from the editor) and the *Council of Biology Editors Style Manual* (available for $24 from the Council of Biology Editors, Inc., 9650 Rockville Pike, Bethesda, MD 20814).

Reprints can be ordered at author's expense from the Editor when proof is returned or earlier.

Good photographs of rare and unusual birds, unaccompanied by an article but with caption including species, date, locality and other pertinent information, are wanted for publication in Western Birds. Submit photos and captions to Photo Editor. Also needed are black and white pen and ink drawings of western birds. Please send these, with captions, to Graphics Manager.

WESTERN BIRDS

Volume 33, Number 3, 2002

PATTERNS OF DISTRIBUTION AND ABUNDANCE OF MIGRATORY SHOREBIRDS IN THE INTERMOUNTAIN WEST OF THE UNITED STATES

W. DAVID SHUFORD, GARY W. PAGE, AND LYNNE E. STENZEL, PRBO Conservation Science, 4990 Shoreline Highway, Stinson Beach, California 94970

ABSTRACT: From 1989 to 1995, we coordinated shorebird surveys in wetlands throughout the Intermountain West. Of 39 species, the American Avocet was the most numerous (280,000 in fall). Population estimates also exceeded 50,000 birds for the Black-necked Stilt (fall), American Avocet (spring), Western Sandpiper (fall and spring), and Long-billed Dowitcher (fall) and 10,000 for the Black-necked Stilt (spring), Marbled Godwit (fall and spring), Least Sandpiper (fall and spring), and Long-billed Dowitcher (spring). Great Salt Lake, Utah, held the greatest numbers of shorebirds (380,000 in fall) followed by the Salton Sea, California (88,000 in fall). Eight other sites held >10,000 shorebirds in spring or fall: Harney Basin, Summer Lake, and Lake Abert, Oregon; Lake Lowell, Idaho; Goose Lake, Oregon/California; Mono Lake, California; and Humboldt Wildlife Management Area and the Lahontan Valley, Nevada. An additional 29 sites held >1000. Shorebirds' distribution in the Intermountain West varied by subregions and habitats. Species also varied from being highly concentrated in large numbers at a few sites (e.g., Marbled Godwit) to being spread in small numbers among many sites (e.g., Killdeer). The single greatest threat to intermountain shorebirds is the scarcity of high-quality water for wetlands. The U.S. Shorebird Conservation Plan shows great promise, but it will require vigorous regional implementation to stem and reverse the continuing loss and degradation of wetland and upland habitats used by shorebirds.

Shorebirds are of great conservation concern because of population declines in many species linked to widespread and continuing habitat loss and alteration of the wetland and upland habitats on which they depend (Howe et al. 1989, Morrison et al. 1994, Page and Gill 1994). Efforts to reverse these trends include a system of voluntary reserves in North and South America, known as the Western Hemisphere Shorebird Reserve Network (Myers et al. 1987, Harrington and Perry 1995), and the U.S. Shorebird Conservation Plan (Brown et al. 2001). Still, a dearth of comprehensive information on shorebird distribution and abundance in North America limits these initiatives.

Prior studies of the distribution and abundance of shorebirds in the interior of the central and western United States have focused on intensive surveys of one or a few sites (Taylor et al. 1992, Neel and Henry 1997), on portions of large biogeographic regions (Warnock et al. 1998), on compilation of anecdotal information (Skagen and Knopf 1993, Skagen et al. 1999), or on single species (Jehl 1988). In 1988, Point Reyes Bird Observatory, now PRBO Conservation Science, initiated the Pacific Flyway Project to fill gaps in the knowledge of broad-scale patterns of shorebird use of wetlands in western North America. Results have been published for Baja California (Page et al. 1997), California's Central Valley (Shuford et al. 1998), and the Pacific coast of the contiguous United States (Page et al. 1999). Here we describe patterns of distribution and abundance of migratory shorebirds in wetlands in the arid intermountain western United States, highlight regional threats to shorebirds, and suggest approaches to conserving these populations.

STUDY AREA AND METHODS

Our study area, bounded on the west primarily by the axis of the Sierra Nevada and Cascade Range and on the east by the Rocky Mountains, encompasses all or parts of seven western states (Figure 1). This area corresponds closely with the Intermontane Plateaus, commonly known as the Intermountain West, consisting of the Columbia Plateaus, Basin and Range, and Colorado Plateau physiographic provinces (Fenneman 1946). Although they lie just west of the intermontane boundary, we included a few terminal lakes on the eastern coastal slope of southern California because of their greater affinity with the arid interior than the moister coast. We analyzed no data from western New Mexico.

To make broad geographic comparisons of relative abundance, we divided the survey area into three subregions. The western Great Basin included all sites in eastern Oregon, western Nevada, and eastern California south through Crowley Lake; the eastern Great Basin (and Columbia Plateaus) all sites in eastern Washington, Idaho, eastern Nevada, and Utah; the southern deserts all sites in southern California, southern Nevada, and Arizona (Figure 1).

We defined a "site" as an isolated wetland or a complex of wetlands lying within the same drainage basin. We treated these large wetland complexes as sites: Harney Basin of Malheur National Wildlife Refuge (NWR), Oregon (Stinking, Harney, Mud, and Malheur lakes); Warner Valley, Oregon (Coleman, Greaser, Pelican, N. Campbell, S. Campbell, Flagstaff, Mugwump, Swamp, Anderson, Hart, Alkali, and Crump lakes and MC Ranch); Klamath Basin, California (Lower Klamath and Tule Lake NWRs); Alkali Lakes, California (Upper, Middle, and Lower Alkali lakes); Long Valley, Nevada (Alkali, Calcutta, Crook's/New Year's, Fortynine, and Mud lakes); Lemmon Valley, Nevada (Lemmon Lake, Lemmon Valley sewage ponds, Lemmon Valley warehouse ponds, Silver Lake playa), Lahontan Valley, Nevada (Canvasback Club, Carson Lake, Fallon Tribal Wetland, various farms, Fernley Wildlife Management Area [WMA]/Fernley Sink, Harmon, Lahontan, Leter, Old River, Sheckler, and S-line reservoirs, Mahala and Massie sloughs, Soda Lakes, Stillwater Pond, Stillwater WMA); Ruby Valley,

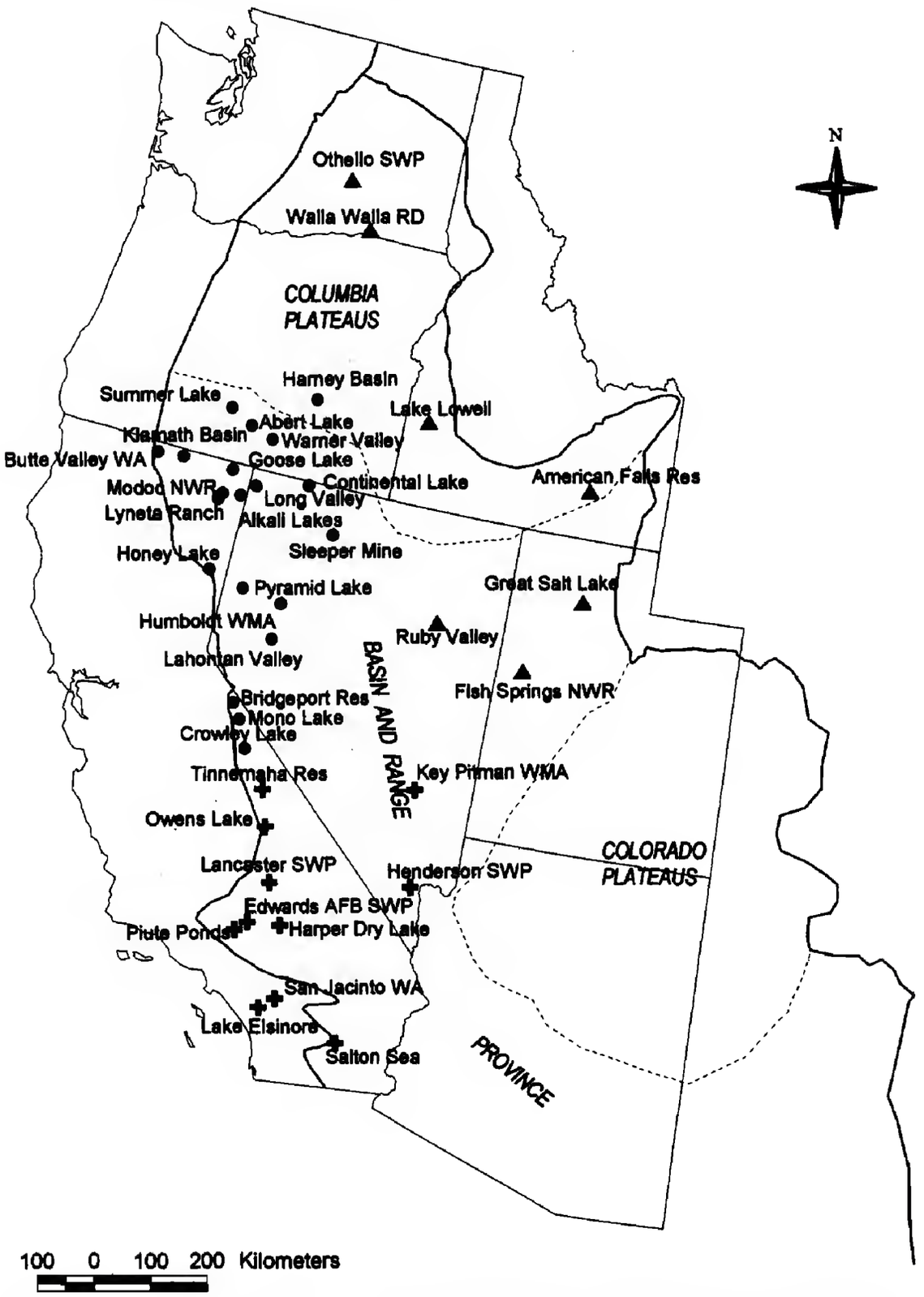


Figure 1. Locations of 38 sites that held >1000 shorebirds on at least one survey, 1989–1995. The Intermontane Plateaus (Intermountain West) study area is outlined by a solid dark line; the Columbia Plateaus, Colorado Plateaus, and Basin and Range physiographic province subregions (Fenneman 1946) are set off by dotted lines. Symbols for sites within three subregions used for analyses: circles, western Great Basin; triangles, eastern Great Basin and Columbia Plateaus; crosses, the southern deserts.

Nevada (Ruby Lake NWR, Franklin Lake WMA); and Lake Mead, Nevada (Lake Mead National Recreation Area [NRA] and Overton WMA).

Our surveys spanned April 1989 through August 1995. We initiated surveys primarily in California and expanded them to nearby states as we identified potential sites of importance to shorebirds and collaborating field observers. With these partners, we attempted to survey shorebirds in all wetlands or other shallow water bodies in the western United States thought, on the basis of published and unpublished literature, knowledge of local experts, and our personal experience, to hold 1000 shorebirds at one time during migration. To enable coverage of such a vast area, we emphasized the geographic extent of surveys at the expense of frequency of censuses. Hence, we tried to ensure coverage of all habitat and the counting of all shorebirds in each wetland annually during periods of one to two weeks each fall (Aug [mostly]-Sept) and one week each spring (late April-early May) for three to five years. We encouraged observers to count on designated weekends within each census period. Observers sometimes covered irrigated agricultural fields, such as those in the Imperial Valley adjacent to the Salton Sea.

PRBO staff and numerous professional and amateur field ornithologists conducted surveys. We provided all observers with a protocol for counting and estimating shorebird numbers under varying conditions. The number of observers needed to conduct a survey ranged from one individual at small sites to more than 10 in multiple teams at some large ones. At most sites observers surveyed on foot, with binoculars and spotting scopes, but at some larger ones they used airboats, fixed-wing aircraft, or a combination of the above. Methods sometimes varied among subareas of a wetland complex or among annual counts. Although there are biases to all methods, at most sites we did not find gross differences in counts using alternative methods. An exception was at Great Salt Lake. Here counts combining results from aerial, airboat, and ground teams conducted in April 1995 and, particularly, August 1994 and 1995 greatly exceeded those on prior counts taken only from the ground. Lower ground counts resulted from limited or no access to some key areas.

We instructed observers, when possible, to identify all shorebirds to species. Groups of unidentified shorebirds fell mostly into four categories: yellowlegs, either Greater or Lesser; small sandpipers of the genus *Calidris*, primarily Western Sandpipers, Least Sandpipers, or Dunlins; dowitchers, either Short-billed or Long-billed; and phalaropes, either Wilson's or Red-necked (see Appendix 1b for scientific names of all species). We assigned unidentified shorebirds to species by the methods described by Page et al. (1999), leaving some unidentified when the ratio of unidentified to identified was high. Our phalarope data in fall are weak, as, even after allocations, high proportions remained unidentified to species, and we generally scheduled our surveys two to three weeks later than the peak passage of the Wilson's Phalarope, an early migrant (Jehl 1988). For analyses, we grouped both identified and unidentified dowitchers as dowitcher spp. because of the difficulty of identifying most individuals to species on surveys of this scale. Still, the vast majority of these birds were likely Long-billed Dowitchers, and

we treat data for dowitcher spp. as pertaining to that species. The only interior site known to hold substantial numbers of the Short-billed in migration is the Salton Sea, though the Long-billed is still more numerous then (Patten et al. in press).

We surveyed 162 sites but set a threshold for inclusion of sites in analyses based on minimum coverage and number of birds detected. We used data from sites that in either season held ≥850 (a natural break in the data near 1000) shorebirds on at least one census or a mean of ≥100 birds on two or more censuses. The 74 sites that met the criteria for inclusion contributed 264 surveys at 63 sites in fall and 235 surveys at 54 sites in spring. The 74 sites accounted for 98% or more of the sum over all sites of both the mean and maximum counts of total shorebirds for fall and spring. From these, we further identified 38 "key" sites that held ≥1000 shorebirds in either fall or spring and were covered at least once in both seasons.

We calculated two abundance estimates of each species or species group at each of the 74 sites in fall and spring: (1) the median count, conditioned on the species' presence (nonzero median), or 0, if all counts were 0, and (2) the maximum count. Because of the large discrepancy among some counts at Great Salt Lake, we calculated medians from only the thorough surveys in August 1994 and 1995 and April 1995. The maxima there, however, are drawn from all seven fall and five spring surveys. Similarly, at the Salton Sea we used four spring and four fall surveys, 1989-1992, to calculate medians and seven spring and seven fall surveys, 1989-1995, to calculate maxima.

We estimated the abundance of shorebirds in the Intermountain West in fall and spring by summing the medians and maxima at all sites. We classified species or species groups with summed medians >10,000 in either season as abundant, those from 1000 to 10,000 as common, and those <1000 as uncommon to rare. We made similar estimates of shorebird abundance in each of the intermountain subregions, using summed medians and converting them to percentages for each subregion. We estimated the broad-scale dispersion of each species by calculating the percentage of total surveys on which each species occurred and counting the number of sites holding at least 1% of the species' median sums. We mapped the regional distribution and relative abundance of shorebirds on the basis of medians from the 38 key sites; abundance categories were based on natural breaks identified by MapInfo Professional 4.1. We categorized species by their breeding and wintering ranges to examine relationships between their abundance and range, modified from Boland (1988, 1991) as described by Page et al. (1999).

Precipitation patterns influencing the extent and availability of suitable shorebird habitat varied greatly during the study. We initiated our surveys in 1989, shortly after the start of a drought, which gripped most of the region through 1993–94, with a brief respite in 1992–93, followed by above-normal precipitation in 1994–95 (Figure 2). Although drought conditions generally reduced the extent of suitable shorebird habitat regionwide, this effect was not uniform across wetlands. Some playa lakes dried up for several years (e.g., Honey Lake, California; 1990–1992, 1994), greatly reducing their capacity to support shorebirds, except in adjacent artificially

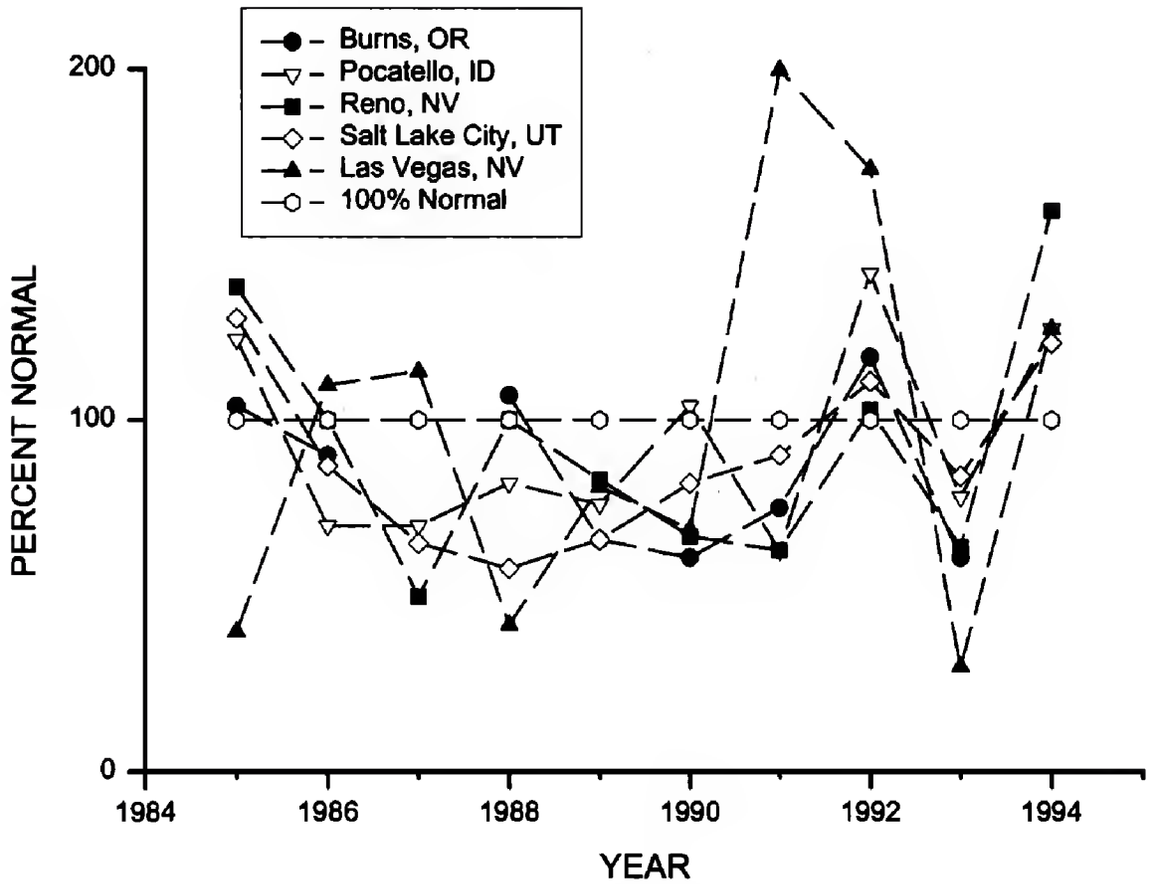


Figure 2. Annual precipitation for the climate year (1 July–30 June), 1985–86 to 1994–95, for five sites in the Intermountain West expressed as the deviation from mean conditions. Data from National Climatic Data Center (http:/www.ncdc.noaa.gov/pub/data/coop-precip/).

maintained wetlands. By contrast, dropping water levels at Goose Lake, Oregon/California, greatly increased the amount of mudflat available to shorebirds over that in wet periods, when water along much of the shoreline laps against low-lying vegetation or rocks.

RESULTS

Species Richness, Overall Abundance, and Seasonal Abundance Patterns

We tallied 39 species of shorebirds in wetlands of the Intermountain West. We recorded 34 species each in fall and in spring but only 28 in both seasons. In at least one season, the sum of medians calculated at all sites totaled >100,000 for the American Avocet, >10,000 to 100,000 for seven species or species groups, and >1000 to 10,000 for eight (Table 1). The summed maxima totaled >100,000 for five species or species groups, >10,000 to 100,000 for six, and >1000 to 10,000 for nine. Although our sum of medians at all sites in fall for the avocet was 280,000, we estimated over 250,000 at Great Salt Lake alone in August 1994 (Appendix 1a). Other species with sums of medians exceeding 50,000 were the Black-necked Stilt in fall, American Avocet in spring, Western Sandpiper in fall and

Table 1 Sum of Medians and Maxima and Percentage Occurrence of Shorebirds in the Intermountain West, 1989–1995[a]

Taxon	Range and (status)[b]	Fall			Spring		
		Median	Maximum	Percentage[c]	Median	Maximum	Percentage[c]
Black-bellied Plover	ab (id)	295	814	22.4 (8)	2570	3583	37.2 (7)
Snowy Plover	tn (sd)	666	1737	36.9 (14)	691	1514	38.5 (15)
Semipalmated Plover	ab (id)	298	575	47.5 (19)	1377	3029	56.8 (18)
Killdeer	tb (sd)	5329	11,750	94.3 (24)	1222	2833	89.3 (29)
Black-necked Stilt	tb (sd)	68,128	101,279	69.6 (4)	10,123	52,158	84.6 (9)
American Avocet	tn (sd)	280,084	391,851	79.5 (8)	58,792	98,065	94.0 (10)
Greater Yellowlegs	ab (id)	531	1210	68.1 (26)	280	935	53.4 (33)
Lesser Yellowlegs	ab (id)	817	2568	61.6 (20)	196	1712	37.2 (22)
yellowlegs spp.[d]	—	1542	4356	81.9 (21)	1240	2962	65.8 (13)
Solitary Sandpiper	as (id)	112	173	31.2 (30)	27	29	9.8 (17)
Willet	tb (sd)	1213	1853	40.3 (6)	5128	7161	68.0 (12)
Spotted Sandpiper	tb (id)	454	1071	66.9 (31)	266	618	48.3 (25)
Whimbrel	aab (id)	95	153	3.8 (7)	8880	11,549	10.7 (3)
Long-billed Curlew	tn (sd)	2180	8192	31.2 (5)	398	1143	48.7 (18)
Marbled Godwit	tn (sd)	15,926	20,699	39.2 (3)	13,402	20,617	29.5 (4)
Ruddy Turnstone	aab (id)	15	42	6.1 (8)	34	48	3.8 (3)
Red Knot	ab (id)	29	34	3.0 (5)	388	548	6.0 (3)
Sanderling	aab (id)	178	416	10.6 (13)	504	634	8.1 (5)
Semipalmated Sandpiper	as (id)	42	69	15.2 (22)	0	0	0.0 (0)
Western Sandpiper	ab (id)	67,849	142,186	81.0 (12)	84,548	188,997	75.6 (11)
Least Sandpiper	ab (id)	8176	24,758	79.1 (21)	13,290	70,555	79.9 (22)
Baird's Sandpiper	as (ld)	452	1127	37.3 (19)	63	210	15.4 (15)
Pectoral Sandpiper	as (ld)	70	130	10.6 (18)	12	12	1.3 (3)
Dunlin	an (id)	82	115	5.3 (11)	6195	22,756	58.1 (10)
Western/Least/ Dunlin[d]	—	103,492	222,974	93.2 (13)	112,719	314,704	95.3 (14)
Stilt Sandpiper	as (ld)	74	114	8.0 (12)	24	37	1.7 (3)
dowitcher spp.[d]	ab, an (id)	76,056	107,966	75.3 (6)	40,889	90,346	75.6 (10)
Common Snipe	tb (sd)	196	442	32.3 (18)	163	323	37.2 (24)
Wilson's Phalarope	ts (id)	19,242	111,918	69.2 (9)	1294	4988	63.7 (16)
Red-necked Phalarope	as (id)	19,993	60,760	51.3 (7)	1542	3169	18.4 (7)
phalarope spp.[d]	—	104,422	173,561	81.1 (5)	1845	7802	66.7 (18)
Total shorebirds	—	670,953	922,971	—	271,902	567,539	—

[a]Median counts conditioned on the species' presence (nonzero median), or 0, if all counts were 0. Based on surveys of 74 wetlands (63 fall, 54 spring). Summary statistics for some species or species groups may also have exceeded thresholds mentioned in the text, depending on the composition of unidentified but unallocated individuals.

[b]aaa, arctic breeder, Oceanic–Asiatic winterer; aab, arctic breeder, bicontinental/Oceanic–Asiatic winterer; ab, arctic breeder, bicontinental winterer; an, arctic breeder, northern winterer; as, arctic breeder, southern winterer; tb, temperate breeder, bicontinental winterer; tn, temperate breeder, northern winterer; ts, temperate breeder, southern winterer. Other shorebirds recorded were the American Golden-Plover (as), Pacific Golden-Plover (aab), Mountain Plover (tn), Wandering Tattler (aab), Hudsonian Godwit (as), Black Turnstone (an), Surfbird (ab), Curlew Sandpiper (aab), Ruff (aaa), and Red Phalarope (as). Migrational status: sd, short distance; id, intermediate distance; ld, long distance.

[c]Numbers in parentheses are the number, based on the sum of medians for all sites, of the 162 total sites holding ≥1% of the species' or species group's total population.

[d]Includes *all* identified and unidentified yellowlegs, *Calidris* sandpipers, Short-billed and (mostly) Long-billed dowitchers, and phalaropes, respectively.

spring, and Long-billed Dowitcher in fall. The Wilson's Phalarope would have exceeded 50,000 if we had surveyed in late July rather than in mid- to late August. Eight species occurred on ≥50% of all surveys in both fall and spring (Table 1), six others on ≥50% of all surveys in one season (3 in fall, 3 in spring). The Black-bellied Plover, Whimbrel, Long-billed Curlew, and Marbled Godwit were the only common to abundant species that did not occur on ≥50% of surveys in either season, whereas the Greater Yellowlegs, Lesser Yellowlegs, and Spotted Sandpiper were the only uncommon species that did.

Sums of medians for 7 of the 15 common to abundant species or species groups were ≥50% higher in fall than in spring (Table 1). Five of the seven (Killdeer, stilt, avocet, curlew, and Wilson's Phalarope) breed in the temperate zone, whereas the other two (dowitchers and Red-necked Phalarope) breed in the arctic. Sums of medians of 5 of the 15 species were ≥50% higher in spring than in fall. Four of the five (Black-bellied and Semipalmated plovers, Whimbrel, and Dunlin) are arctic breeders; the Willet is a temperate-zone breeder. Marbled Godwit totals were not strongly biased toward either season. The large number of unidentified *Calidris* in fall casts uncertainty on a seasonal difference for the Western and Least sandpipers.

Sums of medians for 6 of 11 of the uncommon to rare species were ≥50% higher in fall than in spring and for 3 were ≥50% higher in spring than in fall. The two short-distance migrants that breed in the temperate zone (Snowy Plover and Wilson's Snipe) had negligible seasonal differences (Table 1). The three arctic-breeding long-distance migrants (Baird's, Pectoral, and Stilt sandpipers) were most abundant in fall, as was the Spotted Sandpiper, an intermediate-distance migrant breeding in the temperate zone. Of seven arctic-breeding intermediate-distance migrants, two (Solitary and Semipalmated sandpipers) were most abundant in fall, three (Ruddy Turnstone, Red Knot, and Sanderling) in spring. Seasonal differences for the two yellowlegs species were uncertain because of the high proportion of unallocated individuals. An analogous comparison of sums of maxima yields the same result for the above 11 species, except that the Ruddy Turnstone was not among those with sums ≥50% higher in spring than in fall (Table 1).

Sites of Greatest Importance to Shorebirds

More sites held >10,000 shorebirds in fall than in spring. In fall, on the basis of medians, these included 10 sites: Harney Basin, Summer Lake, and Lake Abert, Oregon; Lake Lowell, Idaho; Goose Lake, Oregon/California; Mono Lake and the Salton Sea, California; Humboldt WMA and the Lahontan Valley, Nevada; and Great Salt Lake, Utah (Appendixes 1a–e). Of these, Great Salt Lake held >380,000 shorebirds and the Salton Sea >88,000. In spring only three sites held >10,000: the Lahontan Valley (42,000), Great Salt Lake (68,000), and the Salton Sea (83,000) (Appendixes 2a–d). Among the 38 sites with spring or fall medians of >1000 total shorebirds in at least one season and data for both seasons, 18 sites held ≥50% higher numbers in fall, 12 held ≥50% higher numbers in spring, and 8 held roughly comparable numbers in both seasons.

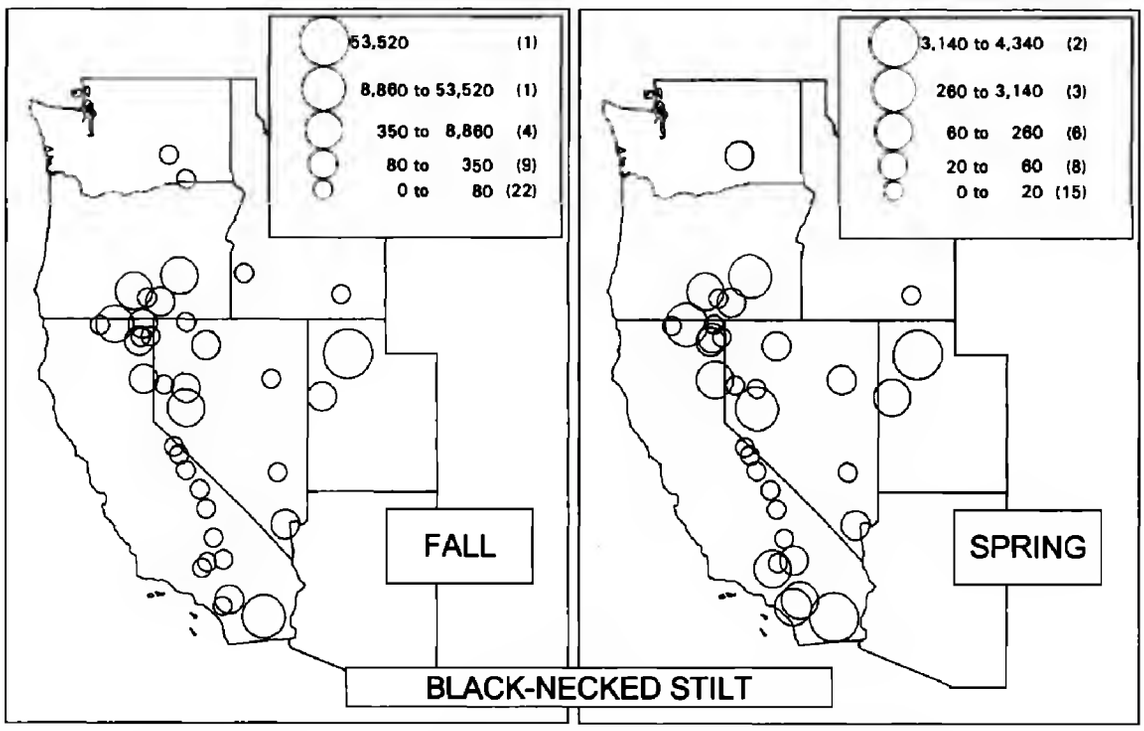


Figure 3. Distribution and abundance of the Black-necked Stilt at 38 key wetlands in the Intermountain West in fall and spring from median counts, 1989–1995.

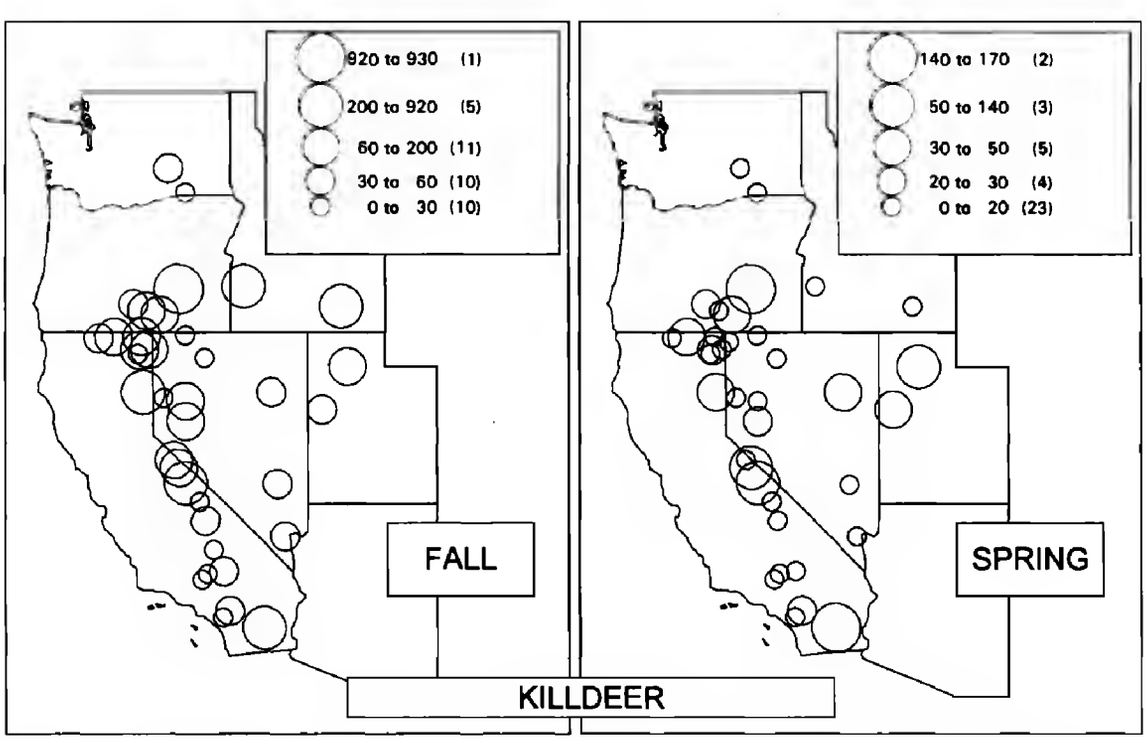


Figure 4. Distribution and abundance of the Killdeer at 38 key wetlands in the Intermountain West in fall and spring from median counts, 1989–1995.

Patterns of Distribution and Relative Abundance

Although most species were widely distributed across intermountain wetlands, they varied from being concentrated primarily in large numbers at a few sites (Table 1, Figure 3) to being spread in small numbers among many sites (Table 1, Figure 4). Eleven common to abundant species concentrated in either fall or spring at ≤10 sites that each held ≥1% of their numbers; five of these concentrated thus at both seasons (Table 1). Of other common to abundant species, only the Killdeer and Least Sandpiper (in both spring and fall) and yellowlegs (in fall) were spread among ≥20 sites that each held ≥1% of their numbers. Of the uncommon to rare species, seven concentrated in either fall or spring at ≤10 sites; the Ruddy Turnstone and Red Knot concentrated thus in both seasons. Six species uncommon to rare in either fall or spring were spread among ≥20 sites that each held ≥1% of their numbers (Table 1). Of these, the Greater and Lesser yellowlegs and Spotted Sandpiper were widely distributed in both seasons, the Solitary and Semipalmated sandpipers in fall, and Wilson's Snipe in spring (though not appreciably more so than in fall).

Shorebirds varied in their patterns of concentration. In fall, common to abundant species or species groups that concentrated particularly were the Black-necked Stilt (78% at Great Salt Lake, 13% at Salton Sea), American Avocet (79% at Great Salt Lake, 5% at Salton Sea), Willet, Whimbrel, and Long-billed Curlew (77%, 62%, 87%, respectively, at Salton Sea), Marbled Godwit (86% at Great Salt Lake), Baird's Sandpiper (25% at American Falls Reservoir, 13% at Lake Lowell), and dowitchers (39% at Great Salt Lake, 20% at Humboldt WMA, 17% at Lahontan Valley, and 13% at Salton Sea). Less numerous species that concentrated primarily at the Salton Sea were the Red Knot (76%), Sanderling (39%), and Stilt Sandpiper (65%).

In spring, common to abundant species or species groups that concentrated particularly were the Black-bellied Plover (68% at Great Salt Lake, 15% at Salton Sea), Black-necked Stilt (42% at Great Salt Lake, 31% at Salton Sea), American Avocet (60% at Great Salt Lake, 11% at Salton Sea), Willet (51% at Great Salt Lake), Whimbrel (88% at Salton Sea, primarily in the adjacent Imperial Valley, 10% at Lancaster sewage ponds in the Antelope Valley), Marbled Godwit (84% at Great Salt Lake, 6% at Salton Sea), small sandpipers (Western, Least, and Dunlin; 33% at Salton Sea, 21% at Lahontan Valley), and dowitchers (34% at Lahontan Valley, 33% at Salton Sea, and 17% at Great Salt Lake). Uncommon to rare species particularly concentrated at the Salton Sea were the Ruddy Turnstone (94%), Red Knot (94%), Sanderling (27%; 65% at Great Salt Lake), and Stilt Sandpiper (92%).

Shorebirds were distributed unevenly among the three subregions of the study area (Table 2). In fall, the eastern Great Basin held a high percentage of total shorebirds, primarily because of the very large numbers of Black-necked Stilts, American Avocets, dowitchers, Marbled Godwits, and phalaropes at Great Salt Lake (Table 2; Appendix 1a). Other uncommon to rare species that were proportionately more numerous in the eastern Great Basin than elsewhere were the Lesser Yellowlegs and Solitary, Semipalmated, and Baird's sandpipers; none of these was particularly numerous at

Table 2 Percentages of 31 Shorebird Species or Species Groups Attributed to Three Regions of the Intermountain West in Fall and Spring[a]

	Fall			Spring		
Taxon	W	E	S	W	E	S
Black-bellied Plover	10.4	19.7	69.9	14.2	68.8	17.0
Snowy Plover	32.9	40.8	26.4	38.5	25.4	36.1
Semipalmated Plover	45.1	15.8	39.0	52.7	1.8	45.6
Killdeer	53.3	29.3	17.4	52.5	23.2	24.3
Black-necked Stilt	6.2	79.7	14.1	17.6	45.3	37.2
American Avocet	15.2	78.8	6.0	25.0	61.4	13.6
Greater Yellowlegs[b]	36.4	32.7	30.9	61.3	9.2	29.4
Lesser Yellowlegs[b]	26.7	61.0	12.3	41.2	34.5	24.3
yellowlegs spp.[c]	27.6	53.9	18.6	18.4	70.2	11.3
Solitary Sandpiper	23.8	48.5	27.7	17.9	35.7	46.4
Willet	9.4	9.5	81.1	40.6	52.9	6.5
Spotted Sandpiper	38.1	36.0	25.9	67.0	13.1	19.8
Whimbrel	2.1	0.0	97.9	0.1	0.0	99.9
Long-billed Curlew	10.2	1.0	88.8	49.0	29.2	21.8
Marbled Godwit	3.8	86.0	10.2	8.7	85.2	6.1
Ruddy Turnstone	60.0	0.0	40.0	3.0	0.0	97.0
Red Knot	20.7	0.0	79.3	5.4	0.0	94.6
Sanderling	38.6	19.7	41.7	7.4	65.3	27.3
Semipalmated Sandpiper	13.8	64.4	21.8	0.0	0.0	0.0
Western Sandpiper[b]	27.7	17.5	54.8	32.3	2.1	65.6
Least Sandpiper[b]	44.0	8.1	47.9	66.5	4.6	28.9
Baird's Sandpiper	26.0	62.1	11.9	39.4	59.2	1.4
Pectoral Sandpiper	29.3	42.1	28.6	100.0	0.0	0.0
Dunlin[b]	71.8	2.3	25.9	93.5	2.0	4.4
Western/Least/Dunlin[c]	33.0	25.0	42.0	52.0	4.4	43.5
Stilt Sandpiper	4.1	25.2	70.8	0.0	0.0	100.0
dowitcher spp.	45.6	40.0	14.4	43.8	17.9	38.3
Wilson's Snipe	61.1	27.7	11.1	59.9	29.1	11.0
Wilson's Phalarope[b]	47.3	40.1	12.6	34.6	26.5	38.9
Red-necked Phalarope[b]	81.2	2.2	16.6	62.2	0.0	37.8
phalarope spp.[c]	36.6	55.8	7.6	48.6	18.8	32.6

[a]W, western Great Basin; E, eastern Great Basin and Columbia Plateaus; S, southern deserts (see Methods, Figure 1). Median sums used to calculate percentages presented in Table 1.

[b]True proportions for these species are uncertain because of the high numbers of unidentified yellowlegs, *Calidris* sandpipers, and phalaropes, respectively.

[c]Includes *all* identified and unidentified yellowlegs, *Calidris* sandpipers, and unidentified phalaropes, respectively.

Great Salt Lake. Of common to abundant species, only the Killdeer was particularly concentrated in the western Great Basin, although that region also held relatively large numbers of American Avocets, Western and Least sandpipers, dowitchers, and phalaropes. The southern deserts held relatively high numbers of Western and Least sandpipers, primarily at the Salton Sea. Many less numerous species also concentrated there, including the Black-bellied Plover, Willet, Whimbrel, Long-billed Curlew, Ruddy Turn-

stone, Red Knot, Sanderling, and Stilt Sandpiper. The relatively high numbers of certain species, such as the Willet, Long-billed Curlew, and Marbled Godwit, at the Salton Sea in fall or spring probably represent birds wintering there rather than migrating through.

In spring, the western Great Basin held a relatively high percentage of the totals of the Semipalmated Plover, Killdeer, Willet, Spotted Sandpiper, Long-billed Curlew, small sandpipers (especially Dunlin), dowitchers, Wilson's Snipe, and phalaropes (Table 2). The eastern Great Basin held high percentages of several common to abundant species, such as the Black-necked Stilt, American Avocet, Willet, and Marbled Godwit, and uncommon to rare species or species groups, such as the Black-bellied Plover, yellowlegs, Sanderling, and Baird's Sandpiper. The southern deserts, particularly the Salton Sea, held high percentages of several common to abundant species or species groups, such as the Semipalmated Plover, Black-necked Stilt, Whimbrel, Western and Least sandpipers, and dowitchers, and of several fairly common to uncommon species, such as the Ruddy Turnstone, Red Knot, and Stilt Sandpiper.

DISCUSSION

Patterns of Seasonal Abundance

Seasonal abundance patterns of shorebirds in the Intermountain West varied by species, as did their likely explanations. Of the seven common to abundant species with numbers higher in fall than in spring, the American Avocet and Wilson's and Red-necked phalaropes are especially adapted to exploit the brine shrimp (*Artemia* spp.) and brine flies (*Ephydra* spp.) so

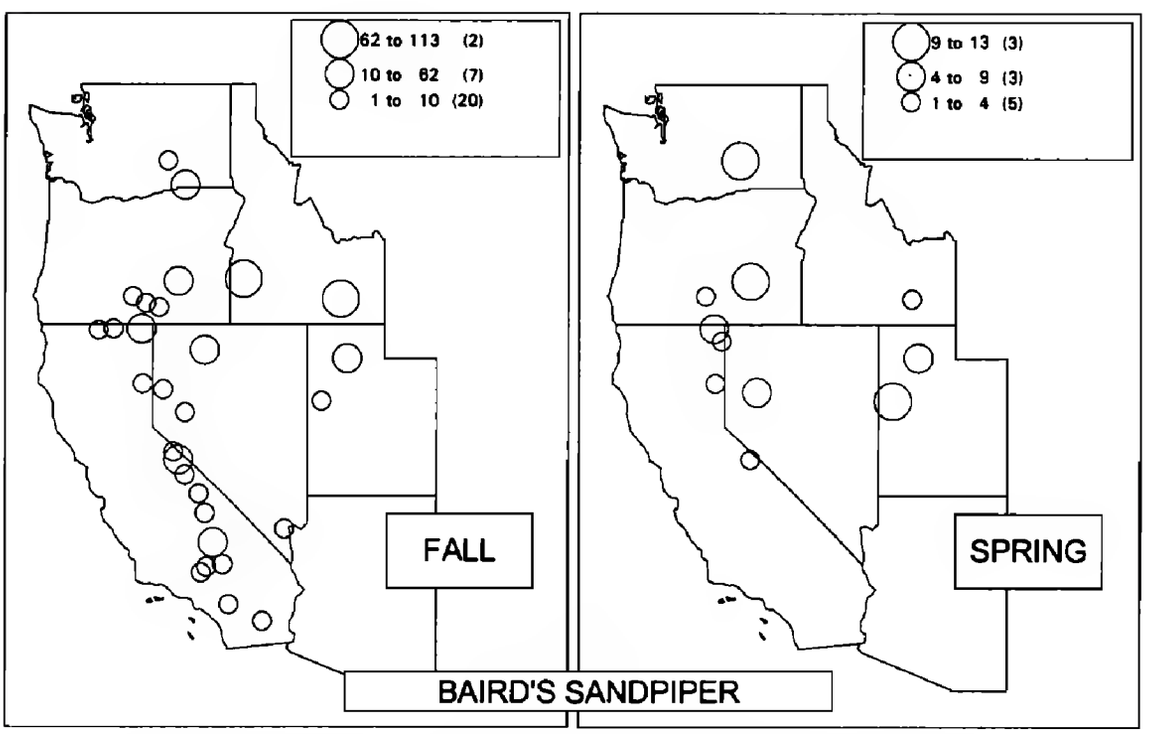


Figure 5. Distribution and abundance of the Baird's Sandpiper at 38 key wetlands in the Intermountain West in fall and spring from median counts, 1989–1995.

abundant in the region's hypersaline lakes in summer and fall (e.g., Jehl 1986, 1988, 1994). The Black-necked Stilt seems to have a secondary affinity for saline lakes, particularly those with adjacent freshwater wetlands, such as Great Salt Lake and the Salton Sea. The greater numbers of the Baird's Sandpiper in fall than in spring are explained by the broader and more westerly migratory pathway of juveniles in fall than of adults in fall and in spring (Figure 5; Jehl 1979); this likely also holds for the Lesser Yellowlegs and the rarer Solitary, Semipalmated, and Pectoral sandpipers, which, like the Baird's, move primarily southeast from arctic breeding grounds to winter in South America. All these species typically are more numerous east than west of the Rockies (Skagen et al. 1999) and were most numerous in the eastern portion of our study area (Table 2). The greater abundance of the Long-billed Curlew in fall than in spring is at first puzzling, as this species departs early from prairie and intermountain breeding grounds and builds to winter levels on the central California coast by late July (Shuford et al. 1989). Its high fall numbers in the Intermountain West reflect mainly the concentration at the Salton Sea (87% of fall numbers), where the species winters primarily in agricultural fields of the Imperial Valley. The greater fall than spring numbers of the Spotted Sandpiper appear to be in part an artifact of our census schedule. This species does not arrive in force in spring in the Great Basin of east-central California until early May (Gaines 1988), after our primary census period. We have no explanation for the greater abundance of the Killdeer and Greater Yellowlegs in fall.

Seasonal patterns of at least three of five common to abundant species most numerous in spring are explained by their patterns of migration. Of

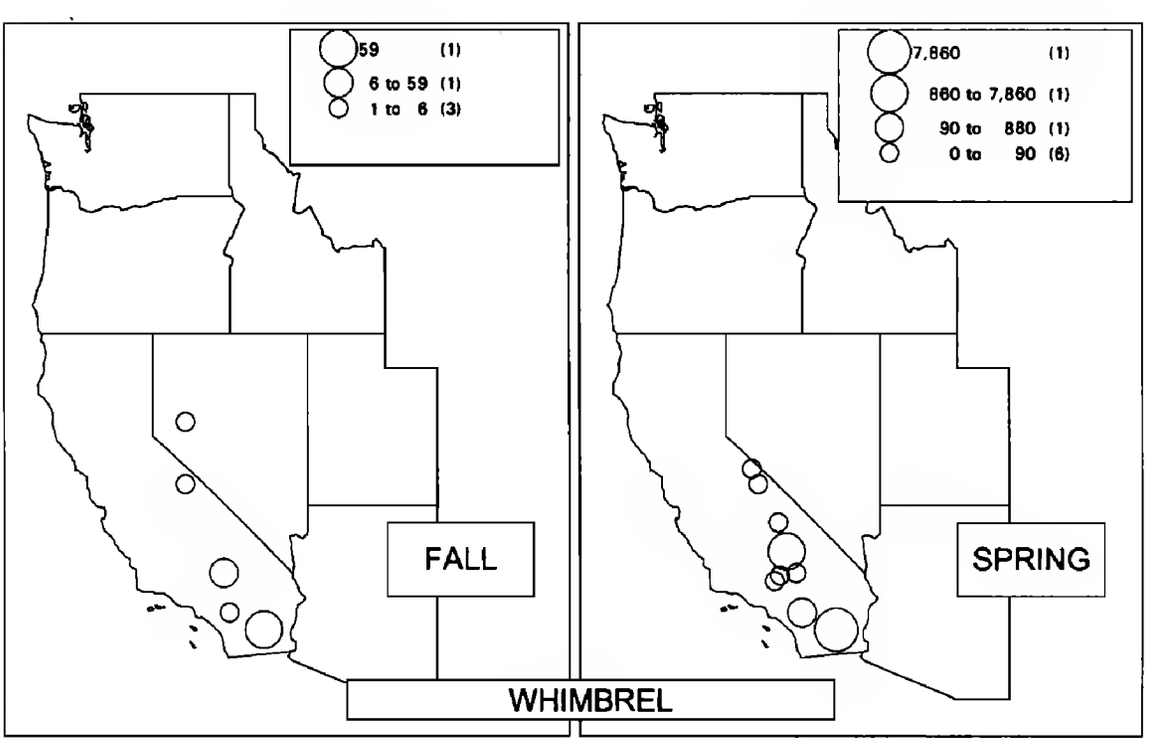


Figure 6. Distribution and abundance of the Whimbrel at 38 key wetlands in the Intermountain West in fall and spring from medians counts, 1989–1995.

these the Willet, like the curlew, departs from intermountain breeding grounds early and reaches winter numbers on the central California coast by late July (Shuford et al. 1989), before our fall inland surveys. The low numbers of the Dunlin in fall reflect that species' southward departure from the North American arctic being delayed until mid-September (Warnock and Gill 1996), after our census period; the species is not numerous in the Intermountain West even in October (e.g., Gaines 1988), perhaps in part because by then temperatures have dropped and food supplies have dwindled. The numbers of Whimbrels being much greater in spring than in fall reflects the species' passing through southern California deserts (Figure 6), particularly in agricultural fields of the Imperial Valley adjacent to the Salton Sea (Shuford et al. in press), on a flight line that leads them to California's Central Valley, where large numbers also occur in spring (Shuford et al. 1998). The numbers in these regions in fall being so low implies a coastal route then. The greater spring than fall numbers of the Black-bellied and Semipalmated plovers (and perhaps Western and Least sandpipers) may be explained by the rapid and concentrated passage of at least some of these arctic breeders in spring (see Iverson et al. 1996 for the Western Sandpiper). Two species rare in the Intermountain West—the Red Knot and Sanderling—are most numerous in spring when they move north from the Gulf of California to the Salton Sea.

For unknown reasons, two abundant species—the Marbled Godwit and Long-billed Dowitcher—and three uncommon to rare species—the Snowy Plover, Ruddy Turnstone, and Wilson's Snipe—occurred in intermountain wetlands in roughly similar numbers in fall and spring. The Snowy Plover was most numerous at alkali lakes, the Long-billed Dowitcher at extensive freshwater wetlands associated with saline lakes. We suspect the Marbled Godwit concentrated primarily at Great Salt Lake in both seasons because of abundant food supplies at a location allowing nonstop flights to both breeding and wintering areas.

The season at which key sites held the greatest numbers of shorebirds reflected in part the types and availability of habitat at each. Of 10 sites with >10,000 shorebirds (based on medians) at either season, 8 held ≥50% more in fall than spring. Of the eight, seven were saline lakes or saline lakes with associated freshwater wetlands; one was a reservoir. Of the four sites with the most striking contrast in seasonal numbers, three are hypersaline lakes—Great Salt, Abert, and Mono—that in fall attract large numbers of phalaropes or avocets. These lakes host abundant brine shrimp and brine flies, which are absent or scarce at the other wetlands (D. Herbst pers. comm.). Lake Lowell held many more shorebirds, particularly small sandpipers, in fall than in spring because very little mudflat is available there until the reservoir is drawn down in summer (Taylor and Trost 1992). Although the Lahontan Valley is a complex of saline and freshwater wetlands, our surveys found more shorebirds there in spring than in fall. This difference may have been an artifact of wetland variability related to climate, as shorebird numbers there subsequent to our survey have been greater in fall than in spring in five of six postdrought years, 1994-1999 (L. Neel and B. Henry unpubl. data); postdrought water availability was further augmented by newly acquired

water rights. Of sites with >10,000 shorebirds, the Salton Sea was unique in hosting roughly similar numbers in spring and fall. The sea is currently not saline enough to favor the brine shrimp and brine flies that would attract large numbers of phalaropes, has a hot climate conducive to invertebrates remaining active year round, and has associated agricultural fields that are particularly attractive to certain species such as the Whimbrel in spring. Other sites with <10,000 shorebirds and higher numbers in spring than in fall typically had more habitat available in spring because of desiccation over the summer or management practices that maintain high water levels in fall (e.g., Klamath Basin; D. Mauser pers. comm.).

Annual Variation in Abundance

Shorebird numbers varied considerably over the study. Numbers appeared to be greatly affected at some sites by fluctuations in available habitat resulting from the extremes of drought and flood. Total shorebird numbers in the Lahontan Valley, Nevada, generally tracked the extent of wetlands, which declined from 1989 to 1992 and increased thereafter, although shorebirds' response, particularly in spring, lagged behind the increasing acreage (Figure 7). Variation in shorebird numbers on individual wetlands likely also reflected census timing relative to pulses of shorebird movement, weather, broad-scale patterns of wetland availability in an arid environment, and variation in shorebirds' reproductive success and winter survival.

Numbers of certain species in the Intermountain West are particularly variable from year to year. Neel and Henry (1997) estimated 100,000 Long-

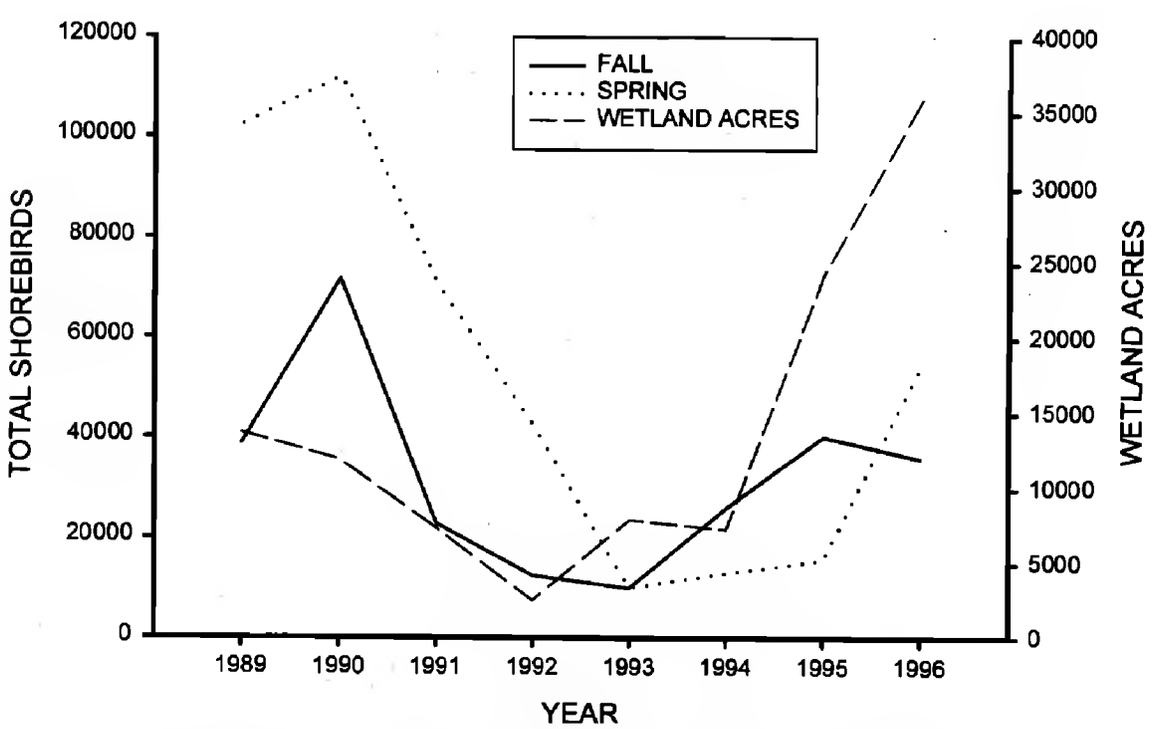


Figure 7. Relationship of annual minimum wetland acres (August) to spring and fall shorebird numbers in the Lahontan Valley, Nevada, 1989–1996. Data on wetland acres and shorebird numbers courtesy of Bill Henry, Stillwater National Wildlife Refuge, and Larry Neel, Nevada Dept. Wildlife, respectively.

billed Dowitchers in the Lahontan Valley in late April and early May in 1987 and 1990, but the median count in late April in other years 1989–2000 was 19,549 (range 2644–39,033; L. Neel, B. Henry unpubl. data). This period included extremes of flood and drought (Figure 7). It is unclear if extremely large numbers of dowitchers reflect very favorable wetland conditions or if large numbers may pass through quickly and be missed by single annual surveys. Similarly, prior estimates of Sanderling numbers at Great Salt Lake have reached 7000 birds in early May (Paton et al. 1992), but the maximum recorded on six Pacific Flyway Project censuses was 329. Paton et al. concluded the species passes through Utah quickly and is very localized there. Jehl (1999) also reported great variation in numbers of Wilson's Phalaropes staging at hypersaline lakes in the Great Basin in autumn (e.g., 67,000 and 7000 birds at Lake Abert in 1982 and 1983, respectively).

Geographic Affinities

Shorebirds using the Intermountain West come from diverse breeding and wintering areas. Among species numerous or widespread in the region in spring, the Snowy Plover, Killdeer, Black-necked Stilt, American Avocet, Willet, Spotted Sandpiper, Long-billed Curlew, Wilson's Snipe, and Wilson's Phalarope breed extensively there, sometimes concentrating at particular wetlands before dispersing more widely to breeding sites. Many others, such as the Western and Least sandpipers and Long-billed Dowitcher, use the area's wetlands as a migratory stopover en route to breeding areas in the western arctic or, in the case of the Marbled Godwit, the northern prairies. Numerous species in the Intermountain West in fall are primarily temperate and arctic breeders using these wetlands en route to northern or bicontinental wintering areas (Table 1). Notable exceptions are the Wilson's and Red-necked phalaropes; the former is a temperate breeder and southern winterer, the latter an arctic breeder that winters primarily offshore south of the Tropic of Cancer. Of the 20 most numerous species (summed maxima >1000), 12 are intermediate-distance migrants, 7 are short-distance migrants, and the Baird's Sandpiper is a long-distance migrant (classification of Skagen and Knopf 1993). These authors noted that large shorebirds and shorter-distance migrants dominate in the Intermountain West, small shorebirds and long-distance migrants in the Great Plains.

Sites of Importance

The Western Hemisphere Shorebird Reserve Network (WHSRN) identifies sites of importance to shorebirds in North America via criteria for three categories: 500,000 shorebirds annually and/or 30% of a species' flyway population (hemispheric), 100,000 and/or 15% (international), and 20,000 and/or 5% (regional). Applying these criteria can be difficult because few guidelines are available for interpreting data, census data often are short-term and do not reveal turnover rates, and data on the size of populations of most species by flyway are limited. Still, three WHSRN sites have been designated in the Intermountain West: Great Salt Lake (hemispheric), Lahontan Valley (hemispheric), and Mono Lake (international) (Harrington and Perry 1995). Many deserving sites have yet to be designated. Largely on

the basis of Pacific Flyway Project data, Harrington and Perry (1995) concluded the Salton Sea qualifies as a site of international importance, Summer Lake, Lake Abert, and Honey Lake as sites of regional importance. Warnock et al. (1998) evaluated Summer Lake, Lake Abert, and Goose Lake, and the WHSRN classification of these sites varied according to the authors' underlying, untested, assumptions.

We found >20,000 shorebirds on a single survey at seven sites not already designated by the WHSRN: Harney Basin, Summer Lake, and Lake Abert, Oregon; Goose Lake and Klamath Basin, Oregon/California; Humboldt WMA/Sink, Nevada; and Salton Sea, California (Appendixes 1a–e, 2a–d). Of these, Lake Abert and Salton Sea had median counts of >20,000 shorebirds, and the Salton Sea had single-day counts of >100,000 in both spring and fall. Solely on the basis of single-day counts, six of these qualify as WHSRN sites of regional importance, the Salton Sea as a site of international importance. The other 29 sites we identified that held >1000 shorebirds do not meet WHSRN criteria, but their importance still should be recognized at some level. Although some other sites in the Intermountain West may have >1000 shorebirds, we suspect these are few and used by such numbers only irregularly. Most large wetlands in the region derive their water from snowmelt from the large mountain ranges—Sierra Nevada, Cascades, Wasatch—at the rim of the Great Basin (Engilis and Reid 1997), where we focused our efforts.

Assessing which wetlands hold high proportions of populations of migratory shorebirds highlights these sites' importance and the species that rely on them particularly. In at least one season Great Salt Lake held >30% of the populations of the American Avocet, Black-necked Stilt, dowitchers, and Marbled Godwit and >5% for the Long-billed Curlew and small sandpipers (mostly Western and Least). Our data are inadequate to reveal the proportion of the populations of phalaropes passing through Great Salt Lake, but this number is likely high. Great Salt Lake was the only wetland that consistently held thousands of Marbled Godwits. Peak counts at Bear River Migratory Bird Refuge (unpubl. data; 7- to 10-day survey intervals, 1992–2000) ranged from 7820 to 35,500 (median 16,913) in fall and from 150 to 26,858 (median 6000) in spring. The Salton Sea held >30% of the populations of the Black-necked Stilt, dowitchers, Long-billed Curlew, Whimbrel, Willet, and small sandpipers and >5% of those of the American Avocet and Marbled Godwit. The Lahontan Valley held >30% of dowitchers, >15% of small sandpipers, and >5% of American Avocets and Long-billed Curlews. Humboldt WMA/Sink held >15% of dowitchers, and Harney Basin, Summer Lake, Lake Abert, Warner Valley, Klamath Basin, Goose Lake, the Alkali Lakes, Lake Lowell, Ruby Valley, Mono Lake, and Lancaster sewage ponds each held >5% of the population of at least one species. Of intermountain wetlands, Great Salt Lake, Lake Abert, and Mono Lake are the most important sites for the Wilson's Phalarope (Jehl 1988).

Beyond their value to particular species, certain sites may be of greater importance than others to particular age or sex classes (see Jehl 1988 for Wilson's Phalarope). Also, regional movements of avocets among sites in the western Great Basin emphasize wetland connectivity and suggest that

complexes of wetlands are of more value than the sum of their parts (Plissner et al. 2000).

WHSRN criteria are based on a "staging paradigm," emphasizing sites hosting large numbers of migratory birds (Robinson and Warnock 1997). Thus sites critical to breeding or wintering birds, supporting species that do not concentrate in large numbers, or are important irregularly during climatic extremes may be overlooked. Relatively numerous yet widely dispersed species in the Intermountain West not likely to be conserved solely by the protection of a few sites are the Snowy Plover, Killdeer, Semipalmated Plover, Greater and Lesser yellowlegs, Willet, Spotted Sandpiper, Long-billed Curlew, and Wilson's Snipe.

Threats to Shorebird Habitats

The greatest threat to shorebird habitat in the Intermountain West is the scarcity of high-quality fresh water (Engilis and Reed 1997, Oring et al. 2000). Water diversions for agricultural and urban uses have greatly reduced the region's historic wetlands, and future demands will increase to meet the needs of an expanding human population. Water diversions also lead to effluent from agriculture or mining entering wetlands, which can degrade water quality by concentrating salts, trace minerals, and nutrients, potentially affecting shorebirds or their prey. Contaminants are of concern at many sites (e.g., Lahontan Valley, Salton Sea), but more needs to be known about their effects on shorebirds. Other known or potential risks facing shorebirds are urban encroachment, human-induced increases in predation rates, harvest of brine shrimp, degradation of breeding habitat from grazing, and agricultural practices that concentrate breeding shorebirds, leaving them vulnerable to predation and being killed by hay-cutting machinery (Reed et al. 1997, Oring et al. 2000).

The future for shorebirds in the Intermountain West is uncertain. Jehl (1994) assessed how changes at eight saline and alkaline lakes in western North America may have affected their ability to support breeding and migratory birds. Of these, Winnemucca Lake, Nevada, has been lost and Owens Lake, California, is seriously degraded. Jehl concluded that Great Salt Lake, Pyramid Lake, and Mono Lake are the only ones likely to remain largely unchanged in their future ability to support current populations of migratory birds. Great Salt Lake, though, is the most modified of all the large salt lakes, and current proposals to create a large freshwater impoundment in the lake, if implemented, could have major effects on the productivity of the south arm. Great concern has recently been expressed about the health of the Salton Sea ecosystem because of potential harm from increasing salinity, mass mortality from diseases and unknown causes, and contaminants (Shuford et al. 2002). Projected increases in salinity there within one to two decades could convert the ecosystem to one dominated by brine shrimp and brine flies. Such a change likely would favor salt-adapted species, such as phalaropes and avocets, but its overall effect on shorebirds is unknown. Proposals to divert additional water flowing to Lake Abert to create marshland and increase irrigation, if implemented, may have a significant adverse effect if diversions exceed 4400 acre-feet/year (Keister

1992). Recent events have begun to reverse decades of wetland degradation in the Lahontan Valley (Neel in Oring et al. 2000). Legislation in 1990 that enabled the purchase of water rights is expected to increase wetland habitat and reduce salinities and concentrations of trace elements if water is managed properly; concerns for mercury contamination are not likely to be mitigated. At Owens Lake, there is cautious optimism as Los Angeles seeks to comply with regulations by pumping ground water to inundate portions of the lakebed to reduce dust storms (Prather in Oring et al. 2000). Although shallow flooding during pilot projects has attracted shorebirds, there is concern over the possible effect of pumping on ground-water levels and spring flow; plans to plant saltgrass (*Distichlis* spp.) may ultimately reduce the amount of water needed for dust abatement.

There is also concern for shorebirds at many of the region's freshwater wetlands. A 1995 federal solicitor's opinion on the Klamath (reclamation) Project increases water priority for endangered species and lowers it for Lower Klamath NWR (USBR 1998). Severe effects are expected, particularly from reduction of the refuge's water supplies in summer and fall; the refuge also suffers from excessive nutrients from agricultural runoff (D. Mauser pers. comm). The spread of perennial pepperweed (*Lepidium latifolium*) on the refuge is reducing the suitability of upland nesting habitat for curlews and Willets and replacing low-growing saltgrass on islands used by nesting stilts and avocets.

The greatest challenge for shorebird conservation in the Intermountain West is to stem the tide of wetland loss. Though the rate of loss in the conterminous United States has slowed substantially, net annual loss from 1985 to 1995 still averaged 47,370 ha (Dahl et al. 1997). Even if these trends are halted or reversed, existing wetlands will need to be managed more intensively to provide for shorebirds. Wetland restoration and enhancement projects will likely be most successful if they restore or at least mimic natural hydrologic function and if wetlands are replaced with ecologic equivalents at the scale of a landscape rather than an individual project (Bedford 1996). Hence, we caution that lost playa lakes not be replaced solely with freshwater ponds.

The U.S. Shorebird Conservation Plan (Brown et al. 2001) shows promise for shorebird conservation by conducting sound research and monitoring, integrating shorebird needs into multispecies management strategies, and increasing public awareness of wetlands and shorebirds. Although the national framework is crucial, its application in the Intermountain West will require local implementation of the regional plan via partnerships with government agencies, nonprofit organizations, and private landowners (Oring et al. 2000). Long-term success will hinge on creative and energetic pursuit of the plan's goals and priorities, particularly via habitat acquisition, protection, and enhancement.

ACKNOWLEDGMENTS

The Pacific Flyway Project was funded by the Bay Foundation of Morro Bay, the Bradford Foundation, the Bureau of Reclamation, the Central Valley Habitat Joint Venture, Chevron USA Inc., the Dakin Foundation, Ducks Unlimited, the Katherine W. Dumke and Ezekiel R. Dumke, Jr. Foundation, Genentech, the Walter and Elise

Haas Fund, the J. M. Long Foundation, the Marin, Morro Coast, and Stockton chapters of National Audubon Society, the National Fish and Wildlife Foundation, the David and Lucille Packard Foundation, the San Francisco Foundation, the Strong Foundation, the True North Foundation, the Dean Witter Foundation, anonymous donors, and members of PRBO. The Pacific Flyway Project was a large-scale cooperative venture, and we are grateful to all who have supported our work, particularly all the participants in our surveys and the landowners and land managers who allowed access to their lands or otherwise provided logistical support. The following people organized counts in key areas or shared data or insights from ongoing studies: Mike Allen, Bert Andersen, Francis Bidstrup, David Blue, Pete Bradley, John Cain, Eugene Cardiff, Chris Carey, Barbara Carlson, Robert Cheney, Kevin Cobble, Martha Collins, Kevin DesRoberts, Walt Devaurs, Fred Dobler, Ray Ekstrom, Joe Engler, Dave Feliz, Suzanne Fellows, Lisa Fitzner, Kimball Garrett, Sue Haig, Murrelet Halterman, Matt Heindel, Tom and Jo Heindel, Bill Henry, Randy Hill, Gary Ivey, Anne Janik, Joseph R. Jehl, Jr., Lin Jensen, George Keister, Carmen Kennedy, Andrew and Leah Kirk, Merlene Koliner, Karen Laslo, Steve Laymon, Nick Lethaby, Dale Litzenberger, Connie Lyons, Jeff Mackay, Bob McKernan, Wesley Martin, Peter Metropulos, Susan Nash, Larry Neel, Lew Oring, Michael Patten, Don Paul, Michael Prather, John Ranlett, Jack Richardson, Paul Roush, Vicki Roy, Margaret Rubega, Ron Ryno, Wayne Shifflett, Ella Sorenson, Marty St. Louis, Andy Stepniewski, Brad Stovall, Emilie Strauss, Steve Summers, Dan Taylor, Chuck Trost, Carole Vande Voorde, Nils and Sarah Warnock, Pat White, Pam Williams, and Greg Wolf. Project staff Catherine Hickey, Janet Kjelmyr, and John Ranlett provided invaluable assistance in database management or field surveys, and Grant Ballard helped produce Figure 1. Don Paul, Utah Division of Wildlife Resources, and Vicki Roy, Bear River Migratory Bird Refuge, provided airplane and airboat support at Great Salt Lake. Modoc and Klamath Basin NWRs provided airboat support for surveys at Goose Lake and the Alkali Lakes. Many thanks to our pilots Steve Biggs, Rich Clough, Jerry Osoro, and Clair Shaffer for their expert flying on our aerial surveys. The manuscript benefited from reviews by Catherine Hickey, Ron LeValley, Larry Neel, and Nils Warnock. This is contribution 719 of PRBO.

LITERATURE CITED

Bedford, B. L. 1996. The need to define hydrologic equivalence at the landscape scale for freshwater wetland mitigation. Ecol. Appl. 6:57–68.

Boland, J. M. 1988. The ecology of North American shorebirds: Latitudinal distributions, community, structure, foraging behaviors, and interspecific competition. Ph.D. dissertation, Univ. Calif., Los Angeles.

Boland, J. M. 1991. An overview of the seasonal distributions of the North American shorebirds. Wader Study Group Bull. 62:39–43.

Brown, S., Hickey, C., Harrington, B., and Gill, R., eds. 2001. The United States Shorebird Conservation Plan, 2nd ed. Manomet Center for Conservation Sciences, P.O. Box 1770, Manomet, MA 02345.

Dahl, T. E., Young, R. D., and Caldwell, M. C. 1997. Status and trends of wetlands in the conterminous United States: Projected trends 1985 to 1995. U.S. Dept. Interior, Fish and Wildlife Serv., Washington, D.C.

Engilis, A., Jr., and Reid, F. A. 1997. Challenges in wetland restoration of the western Great Basin. Int. Wader Studies 9:71–79.

Fenneman, N. M. 1946. Physical divisions of the United States. Map of U.S. Geol. Surv., Reston, VA. Available from USGS Natl. Mapping Div., 345 Middlefield Rd. M/S-532, Menlo Park, CA 94025.

Gaines, D. 1988. Birds of Yosemite and the East Slope. Artemisia Press, Lee Vining, CA.

Harrington, B., and Perry, E. 1995. Important shorebird staging sites meeting Western Hemisphere Shorebird Reserve Network criteria in the United States. U.S. Dept. Interior, Fish and Wildlife Serv., Washington, D.C.

Howe, M. A., Geissler, P. H., and Harrington, B. A. 1989. Population trends of North American shorebirds based on the International Shorebird Survey. Biol. Conserv. 49:185–199.

Howell, S. N. G., and Pyle, P. 1997. Twentieth report of the California Bird Records Committee: 1994 records. W. Birds 28:117–141.

Iverson, G. C., Warnock, S. E., Butler, R. W., Bishop, M. A., and Warnock, N. 1996. Spring migration of Western Sandpipers along the Pacific coast of North America: A telemetry study. Condor 98:10–21.

Jehl, J. R., Jr. 1979. The autumnal migration of Baird's Sandpiper. Studies Avian Biol. 2:55–68.

Jehl, J. R., Jr. 1986. Biology of Red-necked Phalaropes (*Phalaropus lobatus*) at the western edge of the Great Basin in fall migration. Great Basin Nat. 46:185–197.

Jehl, J. R., Jr. 1988. Biology of the Eared Grebe and Wilson's Phalarope in the nonbreeding season: A study of adaptations to saline lakes. Studies Avian Biol. 12:1–74.

Jehl, J. R., Jr. 1994. Changes in saline and alkaline lake avifaunas in western North America in the past 150 years. Studies Avian Biol. 15:258–272.

Jehl, J. R., Jr. 1999. Population studies of Wilson's Phalaropes at fall staging areas, 1980–1997: A challenge for monitoring. Waterbirds 22:37–36.

Keister, G. P., Jr. 1992. The ecology of Lake Abert: Analysis of further development. Tech. Rep. 92-5-02, Ore. Dept. Fish Wildlife, 2501 SW First Ave., P.O. Box 59, Portland, OR 97207.

Morrison, R. I. G., Downes, C., and Collins, B. 1994. Population trends of shorebirds on fall migration in eastern Canada 1974–1991. Wilson Bull. 106:431–447.

Myers, J. P., McLain, P. D., Morrison, R. I. G., Antas, P. Z., Canevari, P., Harrington, B. A., Lovejoy, T. E., Pulido, V., Sallaberry, M., and Senner, S. E. 1987. The Western Hemisphere Shorebird Reserve Network, in The conservation of international flyway populations of waders (N. C. Davidson, and M. W. Pienkowski, eds.), pp. 122–124. Wader Study Group Bull. 49, Suppl./Int. Waterfowl Res. Bur. Spec. Publ. 7.

Neel, L. A., and Henry, W. G. 1997. Shorebirds of the Lahontan Valley, Nevada, USA: A case history of western Great Basin shorebirds. Int. Wader Studies 9:15–19.

Oring, L. W., Neel, L., and Oring, K. E. 2000. Intermountain West regional shorebird plan, version 1.0. Regional report of the U.S. Shorebird Conservation Plan. Manomet Center for Conservation Sciences, P.O. Box 1770, Manomet, MA 02345 (http:/www.manomet.org).

Page, G. W., and Gill, R. E., Jr. 1994. Shorebirds in western North America: Late 1800s to late 1900s. Studies Avian Biol. 15:147–160.

Page, G. W., Palacios, E., Alfaro, L., Gonzalez, S., Stenzel, L. E., and Jungers, M. 1997. Numbers of wintering shorebirds in coastal wetlands of Baja California, Mexico. J. Field Ornithol. 68:562–574.

Page, G. W., Stenzel, L. E., and Kjelmyr, J. E. 1999. Overview of shorebird

abundance and distribution in wetlands of the Pacific coast of the contiguous United States. Condor 101:461–471.

Paton, P. W. C., Kneedy, C., and Sorensen, E. 1992. Chronology of shorebird and ibis use of selected marshes at Great Salt Lake. Utah Birds 8:1–19.

Patten, M. A., McCaskie, G., and Unitt, P. In press. Birds of the Salton Sea: Status, Biogeography, and Ecology. Univ. Calif. Press, Berkeley.

Plissner, J. H., Haig, S. M., and Oring, L. W. 2000. Postbreeding movements of American Avocets and implications for wetland connectivity in the western Great Basin. Auk 117:290–298.

Reed, J. M., Warnock, N., and Oring, L. W., eds. 1997. Conservation and management of shorebirds in the western Great Basin of North America. Int. Wader Studies 9.

Robinson, J. A., and Warnock, S. E. 1997. The staging paradigm and wetland conservation in arid environments: Shorebirds and wetlands of the North American Great Basin. Int. Wader Studies 9:37–44.

Shuford, W. D., Page, G. W., Evens, J. G., and Stenzel, L. E. 1989. Seasonal abundance of waterbirds at Point Reyes: A coastal California perspective. W. Birds 20:137–265.

Shuford, W. D., Page, G. W., and Kjelmyr, J. E. 1998. Patterns and dynamics of shorebird use of California's Central Valley. Condor 100:227–244.

Shuford, W. D., Warnock, N., and McKernan, R. L. In press. Patterns of shorebird use of the Salton Sea and adjacent Imperial Valley, California. Studies Avian Biol.

Shuford, W. D., Warnock, N., Molina, K. C., and Sturm, K. K. 2002. The Salton Sea as critical habitat to migratory and resident waterbirds. Hydrobiologia 473:255–274.

Skagen, S. K., and Knopf, F. L. 1993. Toward conservation of midcontinental shorebird migrations. Conserv. Biol. 7:533–541.

Skagen, S. K., Sharpe, P. B., Waltermire, R. G., and Dillon, M. B. 1999. Biogeographical profiles of shorebird migration in midcontinental North America. Biological Science Report USGS/BRD/BSR—2000-0003. U.S. Govt. Printing Office, Denver.

Taylor, D. M., and Trost, C. H. 1992. Use of lakes and reservoirs by migrating shorebirds in Idaho. Great Basin Nat. 52:179–184.

Taylor, D. M., Trost, C. H., and Jamison, B. 1992. Abundance and chronology of migrant shorebirds in Idaho. W. Birds 23:49–78.

U.S. Bureau of Reclamation. 1998. 1998 Klamath Operations Plan Environmental Assessment. U.S. Bureau of Reclamation, Klamath Basin Area Office, 6600 Washburn Way, Klamath Falls, OR 97603.

Warnock, N., and Gill, R. E. 1996. Dunlin (*Calidris alpina*), in The Birds of North America (A. Poole and F. Gill, eds.), no. 203. Acad. Nat. Sci., Philadelphia.

Warnock, N., Haig, S. M., and Oring, L. W. 1998. Monitoring species richness and abundance of shorebirds in the western Great Basin. Condor 100:589–600.

Accepted 6 January 2002

Appendix 1a Numbers of Shorebirds[a] at Sites in Washington, Idaho, and Utah Holding at Least 1000 Individuals on at Least One Survey in Fall[b]

	Washington		Idaho		Utah		
Species	Othello sewage ponds (5)	Walla Walla R. delta (5)	Lake Lowell (3)	American Falls (6)	Great Salt Lake (7)[c]	Fish Springs (2)	Utah Lake (1)
Black-bellied Plover	0	0	4 (0–4)	1 (0–3)	28 (3–210)	20 (0–20)	0
Snowy Plover	0	0	0	0	221 (58–627)	21 (5–37)	0
Semipalmated Plover	2 (0–2)	2 (0–3)	12 (0–12)	4 (0–13)	2 (0–25)	10 (0–10)	3
Killdeer	30 (17–83)	25 (2–25)	200 (56–855)	238 (95–739)	166 (133–651)	45 (11–79)	555
Black-necked Stilt	8 (0–58)	12 (0–12)	47 (0–47)	18 (0–109)	53520 (2904–65570)	246 (0–246)	400
American Avocet	15 (7–42)	8 (0–13)	30 (27–106)	324 (21–2246)	220272 (25785–252358)	12 (10–15)	56
Greater Yellowlegs	8 (1–11)	2 (0–5)	8 (0–8)	18 (3–122)	47 (3–107)	22 (0–22)	0
Lesser Yellowlegs	34 (8–183)	5 (0–28)	16 (0–16)	184 (12–705)	78 (5–232)	53 (0–53)	10
yellowlegs spp.	42 (10–192)	6 (0–33)	24 (0–24)	210 (18–827)	322 (158–496)	38 (22–53)	10
Solitary Sandpiper	1 (0–1)	4 (0–6)	0	4 (0–6)	3 (0–10)	3 (0–3)	3
Willet	0	0	0	9 (0–30)	94 (3–162)	1 (0–1)	0
Spotted Sandpiper	3 (2–13)	2 (0–2)	21 (0–37)	12 (2–44)	22 (7–52)	10 (0–10)	6
Whimbrel	0	0	0	0	0 (0–1)	0	0
Long-billed Curlew	0	0	1 (0–1)	2 (0–2)	5 (0–8)	0	0
Marbled Godwit	0	1 (0–1)	4 (0–5)	35 (0–144)	13647 (113–16315)	1 (0–1)	0
Ruddy Turnstone	0	0	0	0	0 (0–1)	0	0
Red Knot	0	0	0	0	0 (0–4)	0	0
Sanderling	0	2 (0–2)	0	13 (0–18)	0 (0–92)	5 (0–5)	0
Semipalmated Sandpiper	1 (0–1)	3 (0–3)	2 (0–3)	3 (0–15)	4 (0–5)	0	0
Western Sandpiper	56 (2–593)	285 (110–2750)	2050 (1572–11200)	952 (218–2181)	522 (75–3942)	1168 (154–2181)	320
Least Sandpiper	40 (5–53)	40 (0–55)	8 (1–74)	19 (2–51)	6 (3–710)	24 (12–35)	1
Baird's Sandpiper	4 (0–30)	10 (0–15)	62 (0–88)	112 (22–263)	24 (3–206)	3 (0–3)	0
Pectoral Sandpiper	5 (0–9)	2 (0–2)	0	16 (0–18)	0 (0–5)	0	0
Dunlin	0	0	2 (0–2)	0	0	0	0

rn/Least/							
ılin	97 (7–837)	285 (135–2805)	9746 (2051–11210)	984 (220–2217)	11855 (817–21447)	1191 (189–2193)	321
ındpiper	1 (0–1)	1 (0–1)	0	6 (0–6)	0 (0–2)	0	0
:her spp.	17 (4–141)	28 (27–45)	66 (0–66)	183 (0–752)	30032 (3510–31940)	18 (0–18)	0
ı's Snipe	7 (0–7)	3 (0–3)	1 (0–1)	2 (0–3)	0 (0–2)	2 (2–2)	0
ı's Phalarope	15 (0–38)	0	14 (0–14)	21 (10–324)	7220 (45–41664)	120 (2–238)	0
ecked							
larope	70 (11–557)	22 (0–43)	18 (0–34)	11 (0–103)	119 (0–3550)	0	0
ope spp.	119 (11–595)	22 (0–43)	26 (0–48)	32 (16–427)	57740 (575–66062)	120 (2–238)	0
species	0	1 (0-1)[d]	0	2 (0–2)[e]	1 (0–1)[f]	0	0
;horebirds	348 (139–1425)	314 (238–2886)	11027 (2181–11457)	3114 (491–5780)	387953 (55125–435743)	1588 (269–2906)	1354
er of taxa	17	20	19	24	28	19	9

essed as median and (minimum–maximum).

ber of surveys per site listed in parentheses.

ero median based on two censuses, minimum–maximum on seven censuses (see Methods).

(*Philomachus pugnax*).

onian Godwit (*Limosa haemastica*).

r Golden-Plover (*Pluvialis dominica/P. fulva*).

Appendix 1b Numbers of Shorebirds[a] at Sites in Oregon Holding at Least 1000 Individuals on at Least One Survey in Fall[b]

Species	Harney Basin (6)	Summer Lake (6)	Lake Abert (6)	Warner Valley (6)
Black-bellied Plover *Pluvialis squatarola*	1 (0–7)	4 (0–4)	2 (0–2)	0
Snowy Plover *Charadrius alexandrinus*	14 (0–25)	8 (0–29)	20 (7–99)	0
Semipalmated Plover *C. semipalmatus*	3 (0–15)	25 (0–59)	5 (0–9)	25 (0–25)
Killdeer *C. vociferus*	922 (171–1828)	48 (4–219)	69 (42–148)	122 (27–831)
Black-necked Stilt *Himantopus himantopus*	1353 (1–2436)	353 (163–1546)	49 (0–473)	97 (0–166)
American Avocet *Recurvirostra americana*	1026 (683–2482)	8064 (580–15917)	6684 (1051–34819)	755 (0–2040)
Greater Yellowlegs *Tringa melanoleuca*	38 (2–65)	20 (0–74)	2 (0–3)	6 (0–6)
Lesser Yellowlegs *T. flavipes*	67 (1–197)	17 (2–80)	6 (0–8)	5 (0–9)
yellowlegs spp.	127 (8–254)	44 (23–154)	10 (2–319)	10 (0–124)
Solitary Sandpiper *T. solitaria*	4 (0–4)	2 (0–2)	1 (0–1)	0
Willet *Catoptrophorus semipalmatus*	15 (1–162)	7 (0–12)	4 (0–13)	16 (0–20)
Spotted Sandpiper *Actitis macularia*	23 (0–153)	5 (0–16)	18 (0–22)	24 (0–107)
Whimbrel *Numenius phaeopus*	0	0	0	0
Long-billed Curlew *N. americanus*	28 (1–169)	9 (0–17)	2 (0–7)	21 (0–30)
Marbled Godwit *Limosa fedoa*	9 (0–23)	4 (0–9)	4 (0–6)	20 (0–20)
Ruddy Turnstone *Arenaria interpres*	1 (0–1)	1 (0–1)	4 (0–4)	0
Red Knot *Calidris canutus*	0	0	0	0
Sanderling *C. alba*	9 (0–132)	0	24 (0–39)	6 (0–6)
Semipalmated Sandpiper *C. pusilla*	0	0	0	0
Western Sandpiper *C. mauri*	1790 (1065–8329)	58 (0–6482)	4945 (0–6080)	252 (0–1666)
Least Sandpiper *C. minutilla*	316 (197–815)	78 (2–1464)	320 (0–479)	229 (0–4124)
Baird's Sandpiper *C. bairdii*	14 (0–95)	4 (0–21)	4 (0–6)	6 (0–6)
Pectoral Sandpiper *C. melanotos*	1 (0–46)	8 (0–10)	1 (0–1)	0
Dunlin *C. alpina*	3 (0–3)	25 (0–25)	0	12 (0–12)
Western/Least/Dunlin	3709 (1639–8937)	5276 (3673–7946)	6626 (1385–19313)	501 (16–5802)

Stilt Sandpiper *C. himantopus*	2 (0–2)	0	0	0
dowitcher spp.				
Limnodromus griseus/scolopaceus	2305 (555–5258)	1157 (89–2154)	73 (0–163)	567 (0–625)
Wilson's Snipe *Gallinago delicata*	2 (0–15)	2 (0–4)	1 (0–1)	29 (0–52)
Wilson's Phalarope *Phalaropus tricolor*	430 (0–1739)	190 (2–654)	1918 (0–2500)	65 (0–1260)
Red-necked Phalarope *P. lobatus*	275 (0–996)	64 (20–220)	6590 (0–15630)	256 (0–459)
phalarope spp.	850 (11–1975)	458 (253–680)	12140 (4050–27600)	524 (0–1312)
Other species	0	0	1 (0–1)[c]	0
Total shorebirds	10706 (4611–19980)	16274 (9366–25378)	36399 (6844–75818)	2180 (60–8609)
Number of taxa	24	23	24	19

[a]Expressed as median and (minimum–maximum).

[b]Number of surveys per site listed in parentheses.

[c]Wandering Tattler (*Heteroscelus incanus*).

Appendix 1c Numbers of Shorebirds[a] at Sites in Northern California Holding at Least 1000 Individuals on at Least One Survey in Fall[b]

Species	Butte Valley WA (6)	Klamath Basin (6)	Goose Lake (5)	Modoc NWR (6)
Black-bellied Plover	0	3 (0–4)	5 (0–10)	0
Snowy Plover	0	2 (0–2)	38 (0–43)	0
Semipalmated Plover	5 (0–6)	2 (0–24)	25 (0–40)	2 (0–4)
Killdeer	33 (0–103)	146 (84–221)	96 (2–299)	73 (46–165)
Black-necked Stilt	26 (0–197)	373 (37–645)	127 (22–358)	53 (0–210)
American Avocet	55 (0–296)	74 (4–768)	3473 (1081–10310)	11 (0–41)
Greater Yellowlegs	5 (0–41)	18 (3–33)	5 (0–7)	24 (0–29)
Lesser Yellowlegs	3 (0–17)	2 (0–11)	6 (0–7)	4 (0–68)
yellowlegs spp.	8 (0–44)	22 (3–37)	11 (0–14)	24 (7–97)
Solitary Sandpiper	1 (0–1)	0	0	2 (0–2)
Willet	1 (0–1)	6 (0–12)	33 (1–115)	2 (0–3)
Spotted Sandpiper	2 (0–2)	6 (0–20)	11 (0–54)	4 (0–8)
Whimbrel	0	0	0	0
Long-billed Curlew	0	34 (0–36)	48 (0–95)	1 (0–1)
Marbled Godwit	3 (0–3)	1 (0–1)	14 (0–52)	2 (0–2)
Ruddy Turnstone	0	0	2 (0–2)	0
Red Knot	0	0	2 (0–2)	0
Sanderling	0	0	2 (0–2)	0
Semipalmated Sandpiper	0	0	1 (0–1)	0
Western Sandpiper	24 (0–1246)	176 (30–641)	5621 (0–16853)	53 (0–185)
Least Sandpiper	92 (0–196)	68 (14–157)	894 (0–1480)	15 (0–119)
Baird's Sandpiper	2 (0–2)	4 (0–5)	27 (0–36)	0
Pectoral Sandpiper	0	3 (0–3)	0	0
Dunlin	0	0	0	0
Western/Least/Dunlin	276 (4–1442)	282 (60–798)	6515 (1006–18333)	65 (0–304)
Stilt Sandpiper	0	0	0	0
dowitcher spp.	25 (0–256)	633 (20–978)	131 (0–326)	331 (136–1675)
Wilson's Snipe	0	1 (0–3)	4 (0–4)	32 (0–64)
Wilson's Phalarope	10 (0–34)	44 (1–283)	14 (0–453)	9 (1–254)
Red-necked Phalarope	11 (0–11)	110 (0–159)	263 (0–506)	0
phalarope spp.	11 (0–34)	103 (41–345)	45 (2–959)	9 (1–254)
Total shorebirds	452 (30–2277)	2021 (325–2622)	17065 (2198–23399)	614 (294–1907)
Number of taxa	16	19	23	16

[a]Expressed as median and (minimum–maximum).

[b]Number of surveys per site listed in parentheses.

Lyneta Ranch (4)	Alkali Lakes (1)	Honey Lake (6)	Bridgeport Res. (5)
3 (0–3)	0	1 (0–1)	1 (0–1)
0	28	5 (0–8)	4 (0–4)
0	0	8 (0–8)	2 (0–7)
22 (4–42)	140	224 (23–462)	85 (50–554)
82 (1–337)	9	232 (5–504)	9 (0–69)
45 (0–63)	4607	200 (76–994)	140 (42–310)
8 (0–42)	0	10 (1–44)	18 (13–29)
51 (0–83)	0	5 (0–16)	2 (0–52)
27 (0–125)	0	14 (1–44)	20 (13–81)
2 (0–2)	0	2 (0–2)	2 (0–2)
0	1	2 (0–9)	3 (0–5)
0	0	6 (0–13)	4 (0–15)
0	0	0	0
0	0	2 (0–7)	1 (0–1)
0	0	8 (0–41)	5 (0–8)
0	0	0	0
0	0	1 (0–1)	0
0	0	19 (0–19)	1 (0–1)
0	0	1 (0–1)	1 (0–1)
25 (4–100)	45	66 (11–154)	150 (21–547)
36 (1–52)	0	108 (6–522)	196 (22–790)
0	0	7 (0–7)	6 (0–10)
2 (0–2)	0	0	0
0	0	9 (0–9)	0
52 (26–150)	229	220 (53–626)	346 (43–1038)
0	0	0	1 (0–1)
485 (0–558)	50	158 (24–284)	87 (9–247)
2 (0–8)	0	6 (0–7)	4 (0–10)
164 (0–217)	0	67 (8–363)	15 (5–756)
82 (0–155)	0	46 (6–1686)	61 (10–264)
172 (0–372)	5	124 (47–1711)	73 (15–941)
615 (85–1577)	5069	1570 (415–3203)	1603 (224–2006)
14	8	24	23

Appendix 1d Numbers of Shorebirds[a] at Sites in Central and Southern California Holding at Least 1000 Individuals on at Least One Survey in Fall[b]

Species	Mono Lake (7)	Crowley Lake (6)	Owens Lake (7)
Black-bellied Plover	8 (0–50)	2 (0–2)	0
Snowy Plover	49 (7–216)	4 (0–7)	4 (1–17)
Semipalmated Plover	12 (0–30)	1 (0–14)	4 (1–10)
Killdeer	66 (30–202)	255 (0–420)	51 (7–72)
Black-necked Stilt	36 (0–133)	39 (0–108)	13 (3–31)
American Avocet	7652 (2191–10999)	67 (0–173)	467 (236–1007)
Greater Yellowlegs	4 (1–16)	8 (0–38)	10 (1–22)
Lesser Yellowlegs	9 (1–15)	4 (0–6)	5 (0–10)
yellowlegs spp.	13 (2–31)	8 (0–43)	11 (6–27)
Solitary Sandpiper	2 (0–4)	2 (0–2)	3 (0–13)
Willet	11 (4–35)	8 (0–16)	2 (0–6)
Spotted Sandpiper	34 (0–53)	3 (0–11)	5 (0–10)
Whimbrel	0	1 (0–1)	0
Long-billed Curlew	19 (1–43)	1 (0–1)	11 (7–17)
Marbled Godwit	5 (1–124)	2 (0–16)	3 (0–12)
Ruddy Turnstone	2 (0–2)	0	1 (0–1)
Red Knot	3 (0–4)	0	0
Sanderling	3 (0–6)	0	1 (0–1)
Semipalmated Sandpiper	1 (0–1)	0	3 (0–3)
Western Sandpiper	810 (272–4043)	129 (0–206)	846 (38–2717)
Least Sandpiper	305 (24–1408)	162 (0–1288)	485 (250–728)
Baird's Sandpiper	19 (2–31)	4 (0–4)	6 (0–8)
Pectoral Sandpiper	2 (0–2)	0	2 (0–2)
Dunlin	6 (0–12)	0	10 (0–10)
Western/Least/ Dunlin	1069 (514–5451)	368 (0–1450)	2042 (810–3445)
Stilt Sandpiper	0	0	0
dowitcher spp.	27 (4–46)	27 (0–148)	23 (9–87)
Wilson's Snipe	2 (0–7)	11 (0–14)	8 (0–12)
Wilson's Phalarope	5478 (552–46792)	28 (1–961)	14 (0–245)
Red-necked Phalarope	7296 (75–19000)	10 (0–14)	57 (7–131)
phalarope spp.	21520 (6591–46872)	30 (1–975)	133 (57–287)
Other species	4 (0–5)[d]	0	0
Total shorebirds	31432 (13091-50916)	907 (7-1963)	2811 (1314-4225)
Number of taxa	28	21	24

[a]Expressed as median and (minimum–maximum).

[b]The following sites in southern California that held at least 1000 shorebirds in spring did not do so in fall: Tinnemaha Res. (6 counts, 994 maximum), Lancaster sewage ponds (4, 463), Harper Dry Lake (4, 446), Lake Elsinore (1, 322). Number of surveys per site listed in parentheses.

[c]Nonzero median based on four censuses, minimum–maximum on seven censuses (see Methods).

[d]Mountain Plover (*Charadrius montanus*) and Red Phalarope (*Phalaropus fulicarius*).

[e]Mountain Plover, Wandering Tattler (*Heteroscelus incanus*), and Black Turnstone (*Arenaria melanocephala*).

Edwards AFB sewage ponds (2)	Piute Ponds (7)	San Jacinto WA (5)	Salton Sea (7)[c]
1 (1–1)	1 (0-1)	0	202 (98–478)
6 (6–6)	2 (0–3)	6 (0–6)	114 (72–389)
2 (1–4)	3 (1–5)	8 (0–14)	78 (38–131)
11 (2–20)	19 (3–31)	35 (9–134)	421 (132–777)
52 (4–100)	65 (6–214)	90 (39–315)	8861 (2341–19255)
45 (30–60)	365 (100–785)	220 (55–250)	15333 (4291–19382)
5 (2–8)	10 (0–22)	32 (0–61)	46 (39–122)
5 (2–8)	4 (0–32)	8 (0–9)	36 (0–157)
10 (10–10)	14 (1–54)	35 (0–70)	77 (41–230)
0	1 (0–3)	0	0
1 (0–1)	2 (0–3)	0	937 (52–1147)
4 (0–4)	2 (0–8)	2 (0–3)	26 (7–82)
0	0	2 (0–2)	59 (0–116)
0	1 (0–3)	5 (0–8)	1900 (243–7476)
3 (2–4)	18 (0–31)	0	1568 (371–3190)
0	0	0	4 (0–29)
0	0	0	22 (0–22)
0	0	0	70 (0–70)
0	1 (0–1)	1 (0–1)	0
425 (200–650)	160 (55–1080)	62 (27–340)	35307 (9336–54374)
110 (40–180)	70 (40–135)	232 (12–815)	2355 (422–4149)
9 (8–10)	2 (0–10)	7 (0–10)	6 (0–23)
0	0	0	0
0	0	0	8 (0–14)
535 (240–830)	240 (108–1215)	325 (74–984)	39166 (10490–54797)
0	0	1 (0–1)	48 (0–85)
26 (0–26)	125 (76–628)	569 (15–805)	10012 (5939–15566)
0	2 (0–2)	1 (0–1)	0
14 (6–22)	18 (0–100)	18 (0–65)	1674 (664–7577)
175 (100–250)	67 (0–170)	1 (0–1)	2744 (150–12265)
189 (106–272)	33 (0–225)	18 (0–65)	6540 (1192–13083)
0	0	0	1 (0–5)[e]
879 (511-1247)	1048 (622-2237)	1406 (345-2163)	88267 (43635-105570)
17	21	19	26

Appendix 1e Numbers of Shorebirds[a] at Sites in Nevada Holding at Least 1000 Individuals on at Least One Survey in Fall[b]

Species	Long Valley (2)	Continental Lake (2)	Sleeper Mine (3)	Pyramid Lake (3)
Black-bellied Plover	0	0	0	0
Snowy Plover	0	0	6 (0–6)	6 (0–8)
Semipalmated Plover	0	0	0	3 (3–12)
Killdeer	0	2 (0–2)	11 (8–18)	20 (14–25)
Black-necked Stilt	0	2 (0–2)	84 (10–94)	5 (0–5)
American Avocet	784 (55–1514)	20 (13–26)	26 (17–125)	1 (0–1)
Greater Yellowlegs	0	0	2 (0–2)	0
Lesser Yellowlegs	0	0	2 (0–3)	0
yellowlegs spp.	0	0	3 (0–3)	0
Solitary Sandpiper	0	0	0	1 (0–1)
Willet	0	0	0	0
Spotted Sandpiper	0	0	6 (3–10)	3 (0–3)
Whimbrel	0	0	0	0
Long-billed Curlew	0	0	11 (0–21)	4 (0–4)
Marbled Godwit	0	0	4 (0–8)	2 (0–2)
Sanderling	0	0	0	2 (0–2)
Semipalmated Sandpiper	0	0	0	0
Western Sandpiper	0	0	164 (0–237)	108 (90–1200)
Least Sandpiper	0	0	27 (14–52)	40 (18–400)
Baird's Sandpiper	0	0	11 (0–11)	3 (0–4)
Pectoral Sandpiper	0	0	0	1 (0–1)
Dunlin	0	0	0	0
Western/Least/Dunlin	0	1380 (0–1380)	119 (49–289)	148 (108–1600)
Stilt Sandpiper	0	0	0	0
dowitcher spp.	0	25 (0–25)	254 (36–570)	2 (1–2)
Wilson's Snipe	0	0	2 (0–2)	0
Wilson's Phalarope	0	0	25 (18–119)	4 (0–4)
Red-necked Phalarope	0	0	39 (39–346)	0
phalarope spp.	0	58 (2–115)	58 (57–465)	4 (0–4)
Total shorebirds	784 (55–1514)	782 (17–1548)	815 (270–1280)	203 (129–1647)
Number of taxa	1	6	16	16

[a]Expressed as median and (minimum–maximum).

[b]Number of surveys per site listed in parentheses.

Humboldt WMA (2)	Lahontan Valley (7)	Ruby Valley (5)	Key Pitman WMA (4)	Henderson sewage ponds (5)
0	1 (0–5)	0	0	1 (0–1)
4	13 (0–28)	0	0	2 (0–3)
0	6 (0–34)	4 (0–4)	2 (0–2)	2 (0–5)
100	93 (20–244)	54 (34–145)	45 (25–80)	40 (30–122)
235	960 (394–5814)	23 (4–446)	25 (0–70)	85 (30–173)
2355 (500–4210)	5826 (845–23711)	47 (7–504)	8 (1–16)	78 (0–161)
0	19 (0–47)	0	11 (0–16)	3 (2–9)
0	12 (1–101)	8 (0–15)	4 (0–7)	12 (0–32)
0	66 (32–280)	10 (1–18)	12 (0–23)	16 (2–35)
2	1 (0–3)	0	1 (1–16)	1 (0–1)
0	3 (0–17)	10 (4–35)	2 (0–2)	1 (0–1)
0	8 (2–15)	14 (0–35)	22 (17–29)	6 (0–7)
0	1 (0–1)	0	0	0
0	56 (0–195)	15 (0–21)	1 (0–1)	0
385	106 (44–226)	4 (0–4)	1 (0–1)	1 (0–1)
2	0	0	0	0
0	2 (0–2)	0	0	1 (0–1)
3267	996 (304–2080)	70 (0–70)	42 (21–2262)	12 (0–669)
363	221 (60–1551)	0	11 (0–18)	41 (0–170)
0	2 (0–8)	0	0	2 (0–2)
0	2 (0–5)	0	0	0
0	1 (0–23)	0	0	0
3630	2397 (412–13245)	93 (15–300)	54 (35–2280)	67 (9–839)
0	0	0	2 (0–2)	0
15000	13204 (4541–28906)	46 (0–72)	24 (0–24)	19 (9–56)
2	6 (0–8)	23 (0–135)	1 (0–1)	0
130	396 (2–2876)	288 (0–616)	55 (0–273)	220 (120–250)
40	1001 (216–2897)	23 (0–23)	0	29 (0–29)
170	1569 (1104–4532)	50 (23–616)	55 (0–273)	225 (120–250)
12120 (500–23740)	25753 (10193–72452)	724 (245–2036)	226 (83–2757)	516 (256–1633)
13	23	14	17	19

Appendix 2a Numbers of Shorebirds[a] at Sites in Oregon and Utah Holding at Least 1000 Individuals on at Least One Survey in Spring[b]

	Oregon				Utah
Species	Harney Basin (6)	Summer Lake (6)	Lake Abert (6)	Warner Valley (6)	Great Salt Lake (5)[c]
Black-bellied Plover	4 (1–22)	11(0–36)	0	0	1752 (32–1752)
Snowy Plover	8 (4–107)	4 (2–22)	43 (0–114)	2 (0–2)	110 (98–414)
Semipalmated Plover	7 (0–73)	56 (4–78)	29 (0–34)	12 (0–12)	0 (0–35)
Killdeer	148 (73–223)	21 (6–35)	16 (0–49)	41 (27–118)	90 (90–252)
Black-necked Stilt	268 (31–1660)	62 (19–232)	10 (0–21)	31 (0–37)	4334 (2651–34567)
American Avocet	1243 (192–3368)	1195 (426–2794)	1120 (320–1670)	254 (65–1012)	35462 (7439–39681)
Greater Yellowlegs	7 (0–11)	7 (0–11)	0	12 (0–15)	0 (0–338)
Lesser Yellowlegs	17 (0–71)	2 (0–2)	0	0	9 (9–1281)
yellowlegs spp.	19 (7–80)	6 (0–13)	2 (0–3)	15 (0–19)	826 (73–1885)
Solitary Sandpiper	1 (0–1)	0	0	0	8 (0–8)
Willet	451 (166–782)	214 (39–465)	52 (22–85)	154 (69–232)	2636 (393–2636)
Spotted Sandpiper	16 (0–24)	3 (0–9)	2 (0–2)	10 (0–11)	1 (0–35)
Whimbrel	0	0	0	0	0
Long-billed Curlew	20 (7–32)	18 (5–44)	12 (4–46)	34 (9–443)	38 (38–196)
Marbled Godwit	30 (0–59)	8 (0–86)	0	6 (0–6)	11292 (1889–15302)
Ruddy Turnstone	1 (0–1)	0	0	0	0
Sanderling	1 (0–1)	0	6 (0–6)	0	329 (0–329)
Western Sandpiper	1106 (177–9908)	1602 (0–4056)	113 (0–129)	59 (0–220)	1372 (132–5047)
Least Sandpiper	665 (62–2592)	298 (0–5125)	280 (0–515)	36 (0–1020)	0 (0–168)
Baird's Sandpiper	10 (1–37)	3 (0–3)	0	0	5 (5–88)
Pectoral Sandpiper	9 (0–9)	0	0	0	0
Dunlin	146 (0–220)	345 (0–1053)	199 (0–200)	22 (0–53)	1 (0–2)
Western/Least/Dunlin	3864 (480–12720)	3827 (1265–8806)	1284 (113–11030)	241 (28–1293)	3964 (251–5151)

dowitcher spp.	1244 (318–3140)	164 (86–695)	49 (0–70)	26 (0–64)	7024 (852–7024)
Wilson's Snipe	0	2 (0–2)	0	6 (0–7)	0 (0–7)
Wilson's Phalarope	31 (0–216)	7 (0–17)	5 (0–36)	3 (0–3)	126 (22–505)
Red-necked Phalarope	3 (0–3)	0	0	0	0 (0–21)
phalarope spp.	31 (0–216)	7 (0–17)	20 (0–135)	3 (0–3)	126 (22–505)
Total shorebirds	7135 (2948–20889)	5849 (2114–12791)	2138 (1151–12867)	830 (263–3104)	67997 (16142–101923)
Number of taxa	23	19	15	16	22

[a]Expressed as median and (minimum–maximum).

[b]The following sites in Washington, Utah, and Idaho that held at least 1000 shorebirds in fall did not do so in spring. Washington: Othello sewage ponds (5 surveys, max. count 268), Walla Walla River delta (4, 93); Utah: Fish Springs NWR (1, 851); Idaho: Lake Lowell (1, 70), American Falls Res. (5, 333). Number of surveys per site listed in parentheses.

[c]Nonzero median based on one census, minimum–maximum on five censuses (see Methods).

Appendix 2b Numbers of Shorebirds[a] at Sites in Northern California Holding at Least 1000 Individuals on at Least One Survey in Spring[b]

Species	Butte Valley WA (5)	Klamath Basin (6)	Goose Lake (5)	Lyneta Ranch (4)
Black-bellied Plover	5 (0–8)	76 (2–238)	42 (4–241)	2 (0–8)
Snowy Plover	0	1 (0–1)	34 (16–42)	0
Semipalmated Plover	12 (0–22)	20 (5–80)	35 (2–79)	10 (0–20)
Killdeer	6 (2–8)	30 (22–60)	8 (6–76)	18 (14–32)
Black-necked Stilt	4 (1–9)	588 (325–971)	17 (0–68)	32 (14–58)
American Avocet	279 (49–411)	726 (447–1447)	584 (288–2170)	82 (32–166)
Greater Yellowlegs	3 (1–12)	33 (13–49)	2 (0–2)	10 (1–83)
Lesser Yellowlegs	6 (0–8)	6 (1–12)	0	6 (0–9)
yellowlegs spp.	15 (3–98)	40 (14–65)	2 (0–2)	13 (4–89)
Solitary Sandpiper	0	0	0	0
Willet	30 (10–191)	65 (31–90)	322 (198–676)	32 (20–53)
Spotted Sandpiper	0	4 (0–8)	7 (0–7)	2 (0–2)
Whimbrel	0	0	0	0
Long-billed Curlew	0	14 (0–21)	4 (3–58)	16 (0–16)
Marbled Godwit	3 (0–3)	38 (0–121)	52 (0-153)	95 (0–95)
Red Knot	0	0	2 (0–2)	0
Sanderling	0	0	1 (0–1)	0
Western Sandpiper	637 (0–637)	532 (146–12765)	2271 (778–14605)	64 (21–2354)
Least Sandpiper	76 (0–76)	830 (532–8564)	1233 (72–5111)	51 (8–1820)
Baird's Sandpiper	0	0	4 (1–16)	0
Dunlin	45 (0–45)	1046 (73–2454)	581 (57–1567)	24 (1–112)
Western/Least/ Dunlin	290 (10–2000)	3844 (1478–23783)	6773 (3008–17729)	139 (30–4286)
dowitcher spp.	14 (0–42)	522 (129–2326)	91 (22–511)	589 (0–1143)
Wilson's Snipe	0	4 (0–7)	9 (0–16)	2 (0–2)
Wilson's Phalarope	0	12 (2–24)	7 (2–57)	3 (0–28)
Red-necked Phalarope	230 (0–230)	35 (0–35)	1 (0–1)	0
phalarope spp.	230 (0–230)	13 (2–55)	8 (2–57)	3 (0–28)
Total shorebirds	858 (199–2630)	6616 (2906–28367)	8799 (4806–19190)	746 (269–5674)
Number of taxa	14	18	21	17

[a]Expressed as median and (minimum–maximum).

[b]The following sites in northern California that held at least 1000 shorebirds in fall did not do so in spring: Modoc NWR (5 counts, 561 maximum) and Bridgeport Res. (3, 901). Number of surveys per site listed in parentheses.

Alkali Lakes (6)	Honey Lake (6)	Mono Lake (7)	Crowley Lake (4)
4 (0–16)	26 (2–208)	11 (0–49)	2 (0–2)
19 (9–46)	13 (0–31)	81 (23–135)	2 (0–20)
23 (3–97)	20 (0–179)	159 (70–286)	36 (7–60)
13 (5–29)	48 (10–100)	64 (23–97)	58 (30–124)
7 (0–46)	88 (3–192)	14 (0–82)	7 (0–17)
1124 (38–2464)	556 (334–3318)	425 (15–1564)	82 (17–124)
2 (0–2)	6 (2–19)	4 (0–10)	2 (0–2)
8 (0–8)	1 (0–1)	1 (0–1)	1 (0–1)
2 (0–10)	6 (2–20)	3 (1–10)	2 (0–3)
0	0	1 (0–1)	0
278 (114–602)	116 (58–144)	6 (0–50)	14 (0–32)
1 (0–1)	1 (0–3)	4 (1–209)	115 (0–115)
0	0	2 (0–4)	9 (0–9)
6 (0–8)	8 (0–20)	2 (0–2)	0
44 (0–79)	20 (0–89)	28 (0–36)	1 (0–1)
4 (0–4)	1 (0–1)	3 (0–3)	11 (0–11)
1 (0–1)	0	14 (0–14)	1 (0–1)
1200 (36–2714)	104 (11–2613)	4939 (1570–19107)	614 (255–850)
386 (72-1539)	526 (79–3475)	1178 (148–4810)	186 (28–750)
1(0–10)	2 (0–3)	3(0–3)	0
56 (2–297)	16 (3–643)	313 (88–725)	59 (2–90)
2975 (422–7745)	2330 (684–13709)	6723 (2007–24347)	758 (538–1640)
146 (1–612)	110 (26–818)	22 (8–297)	19 (12–640)
4 (0–11)	1 (0–15)	5 (3–22)	14 (0–14)
10 (0–264)	2 (0–55)	61 (7–1341)	8 (2–514)
9 (0–10)	15 (0–18)	64 (0–227)	573 (0–573)
26 (0–264)	19 (0–70)	190 (7–1568)	8 (2–1087)
4748 (1618–10288)	4071 (1551–17884)	7792 (2683–25616)	1573 (1054–2271)
21	21	24	21

Appendix 2c Numbers of Shorebirds[a] at Sites in Southern California Holding at Least 1000 Individuals on at Least One Survey in Spring[b]

Species name	Tinnemaha Res. (6)	Owens Lake (7)	Lancaster sewage ponds (3)	Piute Ponds (6)
Black-bellied Plover	2 (0–3)	2 (0–3)	1 (0–1)	42 (0–42)
Snowy Plover	2 (0–2)	6 (0–30)	1 (0–1)	2 (0–3)
Semipalmated Plover	32 (0–42)	7 (0–81)	2 (0–2)	23 (3–40)
Killdeer	1 (0–4)	3 (0–6)	0	5 (3–8)
Black-necked Stilt	11 (0–18)	5 (0–45)	5 (1–55)	124 (55–452)
American Avocet	38 (1–124)	668 (442–918)	15 (0–15)	242 (163–500)
Greater Yellowlegs	1 (0–1)	4 (0–10)	0	3 (1–15)
Lesser Yellowlegs	8 (0–12)	2 (0–2)	0	2 (0–5)
yellowlegs spp.	5 (0–12)	4 (0–11)	0	6 (1–16)
Solitary Sandpiper	3 (0–3)	2 (0–3)	0	1 (0–1)
Willet	2 (0–6)	2 (0–4)	0	1 (0–2)
Spotted Sandpiper	1 (0–1)	3 (0–3)	2 (0–2)	3 (0–6)
Whimbrel	0	6 (0–6)	868 (160–1300)	20 (0–60)
Long-billed Curlew	2 (0–2)	2 (0–3)	4 (2–8)	2 (0–2)
Marbled Godwit	0	1 (0–1)	0	3 (0–7)
Ruddy Turnstone	0	0	0	0
Red Knot	0	0	0	1 (0–1)
Sanderling	0	0	0	1 (0–1)
Western Sandpiper	209 (0–610)	396 (76–3317)	100 (55–360)	3755 (1960–12323)
Least Sandpiper	172 (0–434)	824 (273–1649)	22 (0–35)	180 (77–800)
Dunlin	3 (0–11)	2 (1–6)	6 (0–6)	100 (41–300)
Western/Least/Dunlin	483 (0–744)	2904 (901–7525)	106 (90–370)	4322 (2171–12441)
Stilt Sandpiper	0	0	0	0
dowitcher spp.	41 (0–60)	29 (11–74)	0	580 (167–1125)
Wilson's Snipe	1 (0–1)	1 (0–3)	0	2 (0–2)
Wilson's Phalarope	24 (0–46)	8 (0–31)	0	3 (0–20)
Red-necked Phalarope	2 (0–3)	7 (0–14)	0	116 (0–125)
phalarope spp.	2 (0–49)	8 (2–34)	0	20 (0–127)
Other species	0	0	0	1 (0–1)[d]
Total shorebirds	360 (7–1048)	3601 (1505–8497)	1303 (290–1397)	5320 (3096–14429)
Number of taxa	19	21	11	24

[a]Expressed as median and (minimum–maximum).

[b]The following site in southern California that held at least 1000 shorebirds in fall did not do so in spring: Edwards AFB sewage ponds (3 counts, maximum 901). Number of surveys per site listed in parentheses.

[c]Nonzero median based on four censuses, minimum–maximum on seven censuses (see Methods).

[d]Ruff (*Philomachus pugnax*).

[e]Pacific Golden-Plover (*Pluvialis fulva*), Black Turnstone (*Arenaria melanocephala*), Surfbird (*Aphriza virgata*), Curlew Sandpiper (*Calidris ferruginea*), and Red Phalarope (*Phalaropus fulicarius*). See Howell and Pyle (1997) for details of Curlew Sandpiper at Whitewater River mouth, Salton Sea, 16–26 April 1994.

Piute Ponds (6)	Harper Dry Lake (7)	San Jacinto WA (4)	Lake Elsinore (1)	Salton Sea (7)[c]
42 (0–42)	2 (0–3)	1 (0–1)	0	376 (147–579)
2 (0–3)	20 (0–30)	0	0	220 (72–312)
23 (3–40)	12 (0–16)	10 (0–12)	4	545 (105–811)
5 (3–8)	16 (10–53)	22 (6–41)	18	163 (130–717)
124 (55–452)	28 (14–100)	193 (59–315)	144	3149 (1171–10467)
242 (163–500)	86 (18–210)	152 (65–366)	192	6489 (3111–14356)
3 (1–15)	3 (0–7)	5 (0–21)	3	27 (9–102)
2 (0–5)	1 (0–3)	1 (0–1)	0	5 (0–28)
6 (1–16)	2 (0–8)	4 (3–21)	3	42 (11–102)
1 (0–1)	1 (0–1)	0	0	0
1 (0–2)	97 (0–97)	0	3	202 (17–337)
3 (0–6)	1 (0–7)	1 (0–1)	0	7 (4–17)
20 (0–60)	3 (0–10)	98 (0–300)	0	7860 (0–9837)
2 (0–2)	1 (0–1)	17 (0–17)	0	41 (0–102)
3 (0–7)	0	0	8	754 (73–3170)
0	0	0	0	32 (7–46)
1 (0–1)	0	0	0	366 (37–502)
1 (0–1)	0	0	0	135 (0–265)
3755 (1960–12323)	650 (40–1200)	1200 (141–1928)	216	48334 (24474–67343)
180 (77–800)	225 (16–620)	430 (0–825)	47	1684 (197–3476)
100 (41–300)	4 (0–392)	7 (0–13)	12	132 (0–2258)
4322 (2171–12441)	805 (58–1828)	1260 (176–2747)	275	50148 (25555–73077)
0	0	1 (0–1)	0	22 (0–35)
580 (167–1125)	37 (3–170)	809 (380–2154)	580	13366 (8993–26443)
2 (0–2)	3 (1–15)	1 (0–1)	0	3 (0–7)
3 (0–20)	6 (0–19)	1 (0–1)	0	234 (0–416)
116 (0–125)	1 (0–2)	0	0	428 (0–1816)
20 (0–127)	6 (0–19)	1 (0–1)	0	802 (0–1899)
1 (0–1)[d]	0	0	0	6 (0–10)[e]
5320 (3096–14429)	1028 (163–2114)	2374 (1146–5771)	1227	83532 (52559–129538)
24	20	17	11	28

Appendix 2d Numbers of Shorebirds[a] at Sites in Nevada Holding at Least 1000 Individuals on at Least One Survey in Spring[b]

Species	Continental Lake (2)	Humboldt WMA (3)	Lahontan Valley (7)	Ruby Valley (5)
Black-bellied Plover	0	0	166 (0–323)	2 (0–2)
Snowy Plover	6 (0–6)	14 (0–28)	8 (0–62)	0
Semipalmated Plover	6 (0–6)	27 (0–27)	97 (20–658)	0
Killdeer	6 (0–6)	2 (0–2)	18 (5–99)	38 (10–65)
Black-necked Stilt	0	16 (11–152)	286 (156–1261)	24 (12–69)
American Avocet	1554 (519–2588)	180 (69–1754)	4190 (355–12459)	166 (23–1249)
Greater Yellowlegs	0	4 (0–4)	27 (0–48)	7 (0–9)
Lesser Yellowlegs	0	0	2 (1–7)	0
yellowlegs spp.	0	4 (0–4)	28 (3–55)	8 (0–13)
Solitary Sandpiper	0	0	1 (0–1)	0
Willet	26 (12–41)	2 (0–2)	7 (3–15)	43 (38–54)
Spotted Sandpiper	0	0	4 (0–10)	8 (2–44)
Long-billed Curlew	4 (4–5)	0	31 (7–54)	37 (4–50)
Marbled Godwit	71 (0–71)	8 (0–8)	255 (2–518)	5 (0–5)
Sanderling	0	0	1 (0–1)	0
Western Sandpiper	20 (0–20)	2534 (0–5000)	4349 (1949–18002)	0
Least Sandpiper	31 (0–31)	220 (0–255)	1532 (294–22722)	80 (0–125)
Baird's Sandpiper	0	4 (0–6)	0	0
Pectoral Sandpiper	0	1 (0–1)	2 (0–2)	0
Dunlin	0	96 (0–123)	2755 (161–11794)	5 (0–5)
Western/Least/Dunlin	28 (5–51)	323 (115–5378)	23388 (2702–68658)	66 (0–210)
dowitcher spp.	0	498 (0–920)	13944 (2666–39153)	19 (7–213)
Wilson's Snipe	0	0	4 (0–4)	17 (0–30)
Wilson's Phalarope	0	8 (0–8)	84 (2–300)	24 (7–39)
Red-necked Phalarope	0	10 (0–10)	10 (0–30)	0
phalarope spp.	0	9 (0–10)	124 (2–299)	24 (7–39)
Total shorebirds	1657 (547–2767)	411 (398–8285)	42576 (10576–112185)	628 (295–1585)
Number of taxa	9	16	21	14

[a]Expressed as median and (minimum–maximum).

[b]The following sites in Nevada that held at least 1000 shorebirds in fall did not do so in spring: Sleeper Mine wetland (1 count, maximum 355), Pyramid Lake (3, 264), Franklin Lake (5, 332), Key Pitman WMA (3, 29), Henderson sewage ponds (5, 583), Long Valley (1,529). Number of surveys per site listed in parentheses.

Appendix 3. Sites surveyed for shorebirds not included in Appendixes 1a–e and 2a–d. Sites listed alphabetically by state, county, and within counties. Number of counts at each season and maximum count listed in parentheses (fall, spring; maximum with season indicated: F, fall; S, spring).

Averaged >100 shorebirds for at least two counts in a single season or >850 shorebirds on one count in a single season

Arizona

Cochise: Wilcox Playa area (1, 4; 371S).
La Paz: Cibola NWR (1, 3; 259S).
La Paz and Yuma (part Imperial Co., Calif.): Imperial NWR (3, 3; 258F).
Mohave: Havasu NWR (4, 4; 210F).

California

Imperial and Riverside: Palo Verde Valley agricultural fields (3, 2; 298F).
Kern: China Lake sewage ponds (6, 7; 971F), Lake Isabella (6, 4; 389F).
Lassen: Madeline Plains (0, 3; 132S), Willow Creek Wildlife Area (WA) (4, 5; 952S).
Modoc: Clear Lake (2, 1; 431F).
Plumas and Sierra: Sierra Valley (5, 6; 552S).
Shasta: Fall River Valley (0, 2; 525S).

Idaho

Ada: Indian Creek Reservoir (1, 2; 219F).

Nevada

Clark: Overton WMA/Lake Mead NRA (4, 5; 460S).
Elko: Blue Lakes (3, 3; 633F), Dake Reservoir (1, 3; 193S), Jake's Creek Reservoir (2, 2; 291F), Jiggs Reservoir (3, 2; 511F), Snow Water Lake (0, 2; 744S), South Forks Reservoir (2, 3; 550S).
Humboldt: Summit Lake (0, 2; 488S).
Humboldt and Washoe: Sheldon NWR (1, 1; 983F).
Lincoln: Pahranagat NWR (4, 3; 621F).
Nye: Ash Meadows NWR (3, 3; 230F).
Lyon: Mason Valley (5, 5; 760S)
Washoe: Gridley Lake (2, 2; 777S), Massacre Lake (2, 2; 511S), Lemmon Valley (4, 4; 638F), Washoe Lake wetlands (2, 3; 229F).

Washington

Adam and Grant: Columbia NWR (5, 5; 577F).
Benton: Yakima River delta (4, 1; 539F).
Grant: Crab Creek/Hwy 26 Saline Ponds (5, 5; 467F), Potholes Reservoir area (4, 1; 206F), Soap Lake (2, 1; 241F).
Lincoln Co.: Reardon Ponds, (2, 0; 346F).

Averaged <100 shorebirds for at least two counts or had <2 counts in any season

Arizona

Cochise: San Bernardino NWR (0, 1; 1S).
Pima: Buenos Aires NWR (0, 2; 43S).

California

Lassen: Dillon Lake (0, 1; 19S), Said Valley Res. (0, 2; 33S), Silva Flat Res. (0, 2; 69S).
Lassen and Modoc: Ash Creek WA (5, 6; 104S).
Modoc: Big Sage Res. (0, 1; 13S), Donovan Res. (2, 1; 83F), Jesse Valley marshes (0, 1; 13S), Mud Lake (0, 1; 6S), West Valley Res. (0, 1; 32S).
Mono: alkali ponds N of Crowley L. (1, 1; 450S), Hot Creek Gorge (0, 1; 9S), June

Lake sewage ponds (0, 1; 9S), Little Hot Creek (0, 1; 12S), Topaz Lake (0, 1; 23S).
Plumas: pastures northwest shore Lake Almanor (0, 1; 319S).
San Bernardino: East Cronese Dry Lake (1, 0; 756F).

Idaho

Ada: Blacks Creek Res. (1, 1; 124F), Hubbard Res. (0, 1; 25S).
Bingham, Bonneville, and Caribou: Grays Lake NWR (0, 1; 10S).
Bonneville: flooded field W of Idaho Falls (1, 0; 54F).
Camas: Camas Prairie Centennial Marsh WMA (0, 1; 18S), Mormon Res. (0, 1; 14S).
Canyon: Boise River Rd. SW of Notus (1, 1; 79F), Dry Lakes nr. Nampa (2, 1; 85F), Fort Boise WMA (1, 1; 65S), Gem State Academy sewage ponds (0, 1; 17S), Wilson Drainage Pond (0, 1; 76S).
Clearwater: Tolo Lake (0, 1; 9S).
Elmore: Little Camas Res. (0, 1; 23S), Mt. Home Res. (1, 2; 133S).
Franklin: Oxford Slough (0, 1; 48S).
Jefferson: Market Lake (1, 0; 291F), Mud Lake WMA (0, 1; 17S).
Nez Pierce: Clearwater River (1, 0; 21F), Mann Lake (5, 5; 243F).
Owyhee: Bruneau Sand Dunes State Park (0, 1; 26S).
Power: Minidoka NWR (0, 1; 24S).

Nevada

Clark: Glendale Pond (2, 2; 16F), Las Vegas sewage ponds (0, 1; 20S), Logendale (Bowman) Res. (5, 3; 108F).
Douglas: Mud Lake (1, 2; 79S), Settelmeyer Ranches (0, 1; 340S).
Elko: Crintendon Res. (2, 1; 115F), Goshute Lake/marsh (0, 1; 53S), Mary's River (0, 1; 98S), 21 Mile Res. (0, 1; 34S), S. Fork Humboldt River SRA (1, 1; 527F), Wildhorse Res. SRA (2, 0; 179F), Wilson Res. SRA (1, 0; 170F).
Eureka: Diamond Valley (Playa Wells) (1, 0; 22F).
Humboldt: Deer Creek Res. (0, 1; 74S), Hog John Slough at Quinn Lakes (1, 0; 149F), Mud Meadow Res.(1, 1; 47F), Soldier Meadows (0, 1; 1S).
Lyon: Artesia Lake (1, 1; 254S), Wabuska Marshes (1, 2; 60F).
Pershing and Washoe: Winnemucca Lake (0, 1; 46S).
Washoe: Cold Springs Playa (1, 1; 66S), Crooks/New Years Lake (1, 0; 1F), Duck Flat (1, 1; 82S), Parker Res. (0, 1; 178S), Smoke Creek Desert (1, 1; 462F).
White Pine: Bassett Lake and Slough (1, 1; 215F), Comins Lake area (0, 1; 269S), Illipah Res. (0, 2; 25S), Long Valley Slough (0, 1; 18S), Newark Valley (1, 4; 86S), Warm Springs Res. (0, 1; 28S).

Oregon

Harney: Burns sewage ponds (1, 0; 88F).
Lake: Alkali Lake (1, 0; 64F).
Malheur: Antelope Res. (1, 0; 212F), Bully Creek Res. (1, 0; 494F), Cow Lakes (1, 0; 540F), Little Valley Res. (1, 0; 89F), Malheur Res. (1, 0; 249F), Warm Springs Res. (1, 0; 47F).

Utah

Cache: The Barrens (1, 1; 237S).

Washington

Asotin: Anatone Ponds (0, 2; 5S), Savage Rd. pond (2, 1; 35F), Snake River (5, 1; 34F).
Benton: Byron Ponds, Sunnyside WA (1, 1; 106F).
Benton, Franklin, Grant, Yakima: Hanford Reach (0, 1; 47S).
Franklin: Kahlotus Lake (1, 0; 689F).
Grant: wasteways along Dodson Rd. (0, 1; 65S), Saddle Mountain NWR (1, 0; 22F).
Yakima: Priest Rapids Lake (0, 1; 7S).

REPORT OF THE CALIFORNIA BIRD RECORDS COMMITTEE: 2000 RECORDS

TRISTAN McKEE, P. O. Box 631, Ferndale, California 95536

RICHARD A. ERICKSON, LSA Associates, 20 Executive Park, Suite 200, Irvine, California 92614

ABSTRACT: In 2000, the California Bird Records Committee reached decisions on 165 records of 78 species, endorsing 116 of them. New to California were the Glossy Ibis (*Plegadis falcinellus*), seen and photographed west of Calipatria, Imperial County, and Nutting's Flycatcher (*Myiarchus nuttingi*), extensively documented in Irvine, Orange County. From Southeast Farallon Island, San Francisco County, in the late 1980s, one specimen and one in-hand record of the Alder Flycatcher (*Empidonax alnorum*) predate other accepted records. California's bird list now stands at 616 species, nine of which are not native.

This 26th report of the California Bird Records Committee (hereafter the CBRC or the Committee) details the evaluation of 165 records of 78 species. Although most records pertain to birds found in 2000, the period covered by this report spans the 37 years from 1964 to 2001. Eleven of these records were reassessments of earlier Committee decisions. The Committee accepted 116 records, four of them reassessed, involving 52 species. The acceptance rate of 70.3% was below the Committee's mean but consistent with percentages through the 1990s; Morlan and Rottenborn (2000) discussed trends in acceptance rates though the CBRC's history. Forty-two records were not accepted because of insufficient documentation or because descriptions were inconsistent with known identification criteria. Seven additional records were not accepted because of questions concerning the bird's natural occurrence. Counties best represented by accepted records were San Diego (15 records), San Francisco (15, 14 of which were from Southeast Farallon I.), Imperial (11), Inyo (9), Orange (9), Monterey (7), and San Mateo (7). Records were accepted from 15 other counties.

Highlights of this report include the addition of two species to the California list, the Glossy Ibis (*Plegadis falcinellus*) and Nutting's Flycatcher (*Myiarchus nuttingi*). Reports of Markham's Storm-Petrel (*Oceanodroma markhami*), Masked Duck (*Nomonyx dominicus*), Wood Sandpiper (*Tringa gareola*), and Slaty-backed Gull (*Larus schistisagus*), potential first state records, were not accepted because documentation for these reports was insufficient to establish identification or inconsistent with known identification criteria. The Pink-backed Pelican (*Pelecanus rufescens*), Darter (*Anhinga melanogaster*), and Blue Mockingbird (*Melanotis caerulescens*) were not accepted because of concerns over questionable natural occurrence. The CBRC placed the Blue Mockingbird on the Supplemental List (see Patten and Erickson 1994) at its January 2002 meeting. With these changes, California's list stands at 616 species, nine of which are nonnative and two of which have been extirpated within historical times. Acceptance of the Greater Sandplover (*Charadrius leschenaultii*), Common Greenshank (*Tringa nebularia*), and Eyebrowed Thrush (*Turdus obscurus*) to the state list will be addressed in the next report. Records of the Nazca Booby

(*Sula granti*), Falcated Duck (*Anas falcata*), Demoiselle Crane (*Anthropoides virgo*), Whooping Crane (*Grus americana*), Eurasian Collared-Dove (*Streptopelia decaocto*), Yellow-breasted Bunting (*Emberiza aureola*), and Black-backed Oriole (*Icterus abeillei*) are currently under consideration. Other highlights of this report include the state's second Shy Albatross (*Thalassarche cauta*) and Smew (*Mergellus albellus*), the state's first two Alder Flycatchers (*Empidonax alnorum*), a juvenile Short-tailed Albatross (*Phoebastria albatrus*), two Dark-rumped Petrels (*Pterodroma phaeopygia*), a Wilson's Plover (*Charadrius wilsonia*), a Eurasian Dotterel (*Charadrius morinellus*), a Long-billed Murrelet (*Brachyramphus perdix*), and a Field Sparrow (*Spizella pusilla*). California's first spring record of Blue-headed Vireo (*Vireo solitarius*) and second interior record of Sedge Wren (*Cistothorus platensis*) were accepted. Species recorded in especially high numbers in 2000 included the Louisiana Waterthrush (*Seiurus motacilla*; four accepted records, double any previous year's) and Painted Bunting (*Passerina ciris*; nine, the highest ever in a year).

The list of species reviewed by the CBRC is posted at the Western Field Ornithologists' website (http://www.wfo-cbrc.org). This site also includes the entire California state list, the Committee's bylaws, a reporting form for the direct e-mail submission of records to the CBRC, the addresses of current Committee members, a photo gallery of recent submissions (including several birds published in this report), a list of relevant publications by CBRC members, and other information about the CBRC, WFO, and its journal, *Western Birds*.

All documentation reviewed by the CBRC, including copies of descriptions, photographs, videotapes, audio recordings and Committee comments, is archived at the Western Foundation of Vertebrate Zoology, 439 Calle San Pablo, Camarillo, CA 93012, and is available for public review. The CBRC solicits and encourages observers to submit documentation for all species on the review list, as well as species not on the state list. Documentation should be sent to Guy McCaskie, CBRC Secretary, P. O. Box 275, Imperial Beach, CA 91933-0275 (e-mail: guymcc@pacbell.net).

Committee News. The Committee's voting membership after the 19 January 2002 annual meeting consisted of Luke W. Cole, Jon L. Dunn, Richard A. Erickson (chairman), Kimball L. Garrett (vice chairman), Tristan McKee, Joseph Morlan, Michael M. Rogers, Mike San Miguel, Scott B. Terrill, and John C. Wilson. Guy McCaskie continued his role as nonvoting secretary. Recent Committee members who also voted on many of the records in this report include Robert A. Hamilton, Matthew T. Heindel, Alvaro Jaramillo, Guy McCaskie, Michael A. Patten, Peter Pyle, Stephen C. Rottenborn, and Daniel S. Singer.

At the January 2002 meeting, the Committee voted to remove the Reddish Egret (*Egretta rufescens*) from the review list. The Committee also voted to establish three groups in which records may be accepted at the species-pair level: Galapagos/Hawaiian Petrel (*Pterodroma phaeopygia/sandwichensis*), Masked/Nazca Booby (*Sula dactylatra/granti*), and White/Black-backed Wagtail (*Motacilla alba/lugens*). To be admitted to the review list, pairs must involve closely related species in which the species-level

identification of a significant percentage of records cannot be resolved. We nonetheless encourage observers to make every reasonable effort to establish the identification of all individuals to species.

Format and Abbreviations. As in other recent CBRC reports, records are generally listed geographically, from north to south, and/or chronologically by first date of occurrence. Included with each record is the location, county abbreviation (see below), and date span. The date span usually follows that published in *North American Birds* (formerly *American Birds* and *Field Notes*) but, if the CBRC accepts a date span that differs from a published source, the differing dates are italicized. Initials of the observer(s) responsible for finding and/or identifying the bird(s)—if known and if they have supplied supportive documentation—are followed by a semicolon, then the initials, in alphabetized order by surname, of additional observers submitting supportive documentation, then the CBRC record number consisting of the year of submission and chronological number assigned by the secretary. All records are sight records unless otherwise indicated: initials followed by a dagger (†) indicate the observer supplied a supportive photograph, (‡) indicates videotape, (§) indicates a voice recording, and (#) indicates a specimen record, followed by the abbreviation (see below) of the institution housing the specimen and that institution's specimen catalog number.

An asterisk (*) before a species' name indicates that the species is no longer on the CBRC review list. The first number in parentheses after the species' name is the number of records accepted by the CBRC through this report; the second is the number of new records accepted in this report (because this number excludes records thought to pertain to returning individuals, it may be zero). Two asterisks (**) after the species' total indicate that the number of accepted records refers only to a restricted review period or includes records accepted for statistical purposes only; see Roberson (1986) for more information.

When individual birds return to a location after a lengthy or seasonal absence, each occurrence is reviewed under a separate record number, and Committee members indicate whether or not they believe the bird is the same as one accepted previously. Such decisions follow the opinion of the majority of members and, if a bird is considered a returning individual, the total number of records remains unchanged.

Although the CBRC does not formally review the age, sex, or subspecies of each bird, information on these subjects is often provided during the review process, and in some cases the Committee achieves a strong or unanimous consensus. We report much of this information.

The CBRC uses standard abbreviations for California counties; those used in this report are COL, Colusa; DN, Del Norte; HUM, Humboldt; IMP, Imperial; INY, Inyo; KER, Kern; LA, Los Angeles; MRN, Marin; MEN, Mendocino; MOD, Modoc; MNO, Mono; MTY, Monterey; ORA, Orange; RIV, Riverside; SAC, Sacramento; SBE, San Bernardino; SD, San Diego; SF, San Francisco; SJ, San Joaquin; SLO, San Luis Obispo; SM, San Mateo; SBA, Santa Barbara; SCL, Santa Clara; SCZ, Santa Cruz; SIE, Sierra; SOL, Solano; SON, Sonoma; VEN, Ventura. A full list of county abbreviations is available on the WFO–CBRC website. Other abbreviations

used: I., island; L., lake; Mt., mountain; n. miles, nautical miles; N.W.R., national wildlife refuge; Pt., point; R., river; W.M.A., wildlife management area.

Museum collections housing specimens cited in this report, allowing access to Committee members for research, or otherwise cited, are the California Academy of Sciences, San Francisco (CAS), Natural History Museum of Los Angeles County, Los Angeles (LACM), San Diego Natural History Museum (SDNHM), and Western Foundation of Vertebrate Zoology, Camarillo (WFVZ).

RECORDS ACCEPTED

YELLOW-BILLED LOON *Gavia adamsii* (68, 3). One in basic plumage was at Pt. Mugu, VEN, 26 Mar–2 Apr 2000 (DP, ST; WJP, MSM; 2000-071). The viewing distance prevented a detailed study of the upperpart pattern, and neither the observers nor the Committee reached a consensus on the bird's age. Another in basic plumage at Pt. Reyes lighthouse, MRN, 4 Jun 2000 (RS; KMB; 2000-089) furnished only the third accepted record of a bird apparently summering in California. Pyle (pers. comm.) considered this bird to be one year old. A juvenile was on Monterey Bay, MTY (36° 38′ N, 121° 55′ W), 18 Dec 2000–15 Jan 2001 (AJ; LWC†, EPr†; 2001-008).

SHY ALBATROSS *Thalassarche cauta* (2, 1). An immature at Cordell Bank, MRN (38° 07.74′ N, 123° 30.64′ W), 29 Jul 2000 (MWE†, EPr†, SBT†; 2001-144) was considered the same individual seen at 38° 05.8′ N, 123° 32′ W on 10 Sep 2000 (AME, LH, DEQ†, RMS†, MSM†; 2000-129; Figure 1; another photograph was published in *N. Am. Birds* 55:120). The extent of gray on this bird's head and neck led Australian experts and most CBRC members to consider it the subspecies *salvini*, although others were uncomfortable with the identification of immature Shy Albatrosses at this level. Another report from 17 Sep 2000 (*N. Am. Birds* 55:98) has not been submitted to the CBRC. *T. c. salvini* occurs in the Humboldt Current as far north as 6° S (Murphy 1936, Tickell 2000). Adults previously documented in the North Pacific have been assigned to the *cauta/steadi* group (Cole 2000), although a bird seen from shore in San Luis Obispo County, tentatively identified as *salvini*, is being reconsidered by the CBRC. Its identification originally was not accepted at the species level (Rottenborn and Morlan 2000).

SHORT-TAILED ALBATROSS *Phoebastria albatrus* (9**, 1). One was 26 n. miles WSW of Pt. Buchon, SLO (35° 04.6′ N, 121° 20.1′ W), 15 Jan 2000 (DR, TME; NCH†, CAM; 2000-038; Figure 2). This bird's uniformly dark plumage and lack of white eye crescents may suggest juvenal plumage (Rogers and Jaramillo 2002), although age criteria in this species are still under debate.

MANX SHEARWATER *Puffinus puffinus* (61, 8). Two newly submitted reports from 1997 brought the total of accepted records from that year to 11, down slightly from the previous year's high of 13 records. One was W of Pt. Pinos, MTY, 17 Sep 1997 (JLD; 2001-044), and one was seen from shore at Southeast Farallon I., SF, 28 Sep 1997 (PP; 2001-035). Four more records were also accepted from 1999, bringing that year's total to 11: one was seen from shore at Pt. Piedras Blancas, SLO, 28 Apr 1999 (RAR; 2001-160), one was in a feeding flock 26 n. miles WSW of Pt. Pinos, MTY, 6 Sep 1999 (DR; 1999-147), another was on Monterey Bay, MTY (36° 50′ N, 122° 06′ W), 14 Sep 1999 (JLD; 2001-045), and one was on Monterey Bay, SCZ (36° 49′17″ N, 122° 12′27″ W), 9 Oct 1999 (SGM, MMR; 1999-191). Only two reports from 2000 have received a decision: one at Pigeon Pt., SM, 23 Apr 2000 (RST; 2000-111) and one on Monterey Bay, SCZ, 9 Oct 2000 (TMcK; GE; 2000-

Figure 1. California's second Shy Albatross, *Thalassarche cauta*, at Cordell Bank, off Marin County, 10 September 2002. The distinctly gray head led most experts to conclude that the bird belonged to the subspecies *salvini*.

Photo by David E. Quady

142). There are now nine spring records, mostly from shore. June is the only month lacking any accepted records, although a report from Mendocino Co. 2 Jun 2002 will be reviewed by the CBRC. Three summer records are from mid-July onward and may be the first arrivals of the fall, which has accounted for 41 of our records. Most reports from farther north along the Pacific coast are from summer (e.g., *N. Am. Birds* 55:475), which may explain the gap in California reports at this season. Less observer coverage offshore and minimal shore-based seawatching during early summer may also be partially responsible. Indeed, this species' seasonal pattern of occurrence closely mirrors the seasonal frequency of birding-related boat trips and seawatching efforts in California.

DARK-RUMPED PETREL *Pterodroma phaeopygia* (8, 2). Two records from 2000 were accepted by the CBRC before the Amercian Ornithologists' Union (Banks et al. 2002) recognized the Galapagos (*P. phaeopygia*) and Hawaiian (*P. sandwichensis*) Petrels as separate species. The CBRC then voted to add this species pair to the review list, so that unresolved records can be accepted under the category of Galapagos/Hawaiian Petrel. All California records of "Dark-rumped Petrels" will be brought to the next annual meeting for discussion. One was well documented over the W end of Cordell Bank, MRN (37° 99.166′ N, 123° 48.483′ W), 15 Jul 2000 (RS; KMB, AD, GG, LH, CL, LML‡, BDP, EPr†; 2000-101). Another was about 8 n. miles W of Fort Bragg, MEN (39° 27.76′ N, 123° 58.67′ W), 19 Aug 2000 (LH, PP; 2000-155). Accepted records span 3 May–24 Aug, but the six since 1996 all occurred

Figure 2. Short-tailed Albatross, *Phoebastria albatrus*, 26 nautical miles WSW of Point Buchon, San Luis Obispo County, 15 January 2002. The uniformly dark plumage suggests a juvenile; the apparent beginnings of a pale upperwing patch may be a result of wear.

Photo by Norwood C. Hazard

between 15 Jul and 24 Aug. This concentration of records toward the end of the species' window of occurrence may be another reflection of the larger number of offshore birding trips in late summer and fall.

MASKED BOOBY *Sula dactylatra* (15, 1). An adult was in a Brandt's Cormorant (*Phalacrocorax penicillatus*) colony on San Nicolas I., VEN, 5-24 Jun 2000 (SDH; 2000-113). Its bill color was described as yellow, which nine members felt was adequate to eliminate the Nazca Booby (*S. granti*); the lone dissenter felt that more detail on the exact shade of the bill was needed to eliminate that species. The record stands accepted as a Masked Booby, *sensu stricto*.

MASKED/NAZCA BOOBY *Sula dactylatra/granti* (3, 3). Three records accepted as immature Masked Boobies prior to recognition of the Nazca Booby as a distinct species (AOU 2000) were reconsidered and accepted only as pertaining to this species pair: 2 miles W of Pt. Lobos, MTY, 5 Apr 1990 (DL†; 1990-052; Patten and Erickson 1994), Newport Beach, ORA, 30 Jun 1992 (DRW, BED; 1992-210; Heindel and Patten 1996), and 23 n. miles SW of San Miguel I., SBA, 16 Jul 1996 (RLP, SES; 1996-115; Rottenborn and Morlan 2000). The Nazca Booby is unrecorded in California, but a report of one that rode a boat from Mexican waters into San Diego Bay in May 2001 is currently under review. Identification of immatures is problematic (see Pitman and Jehl 1998, Roberson 1998).

BROWN BOOBY *Sula leucogaster* (69, 1). An adult female was seen in flight 1 km NW of Southeast Farallon I., SF, 29 Aug 2000 (SG; 2001-025). A pale-headed adult male of the race *brewsteri* on Southeast Farallon I., SF, 22–28 Oct 2000 (RDB†; 2001-055) was considered a returning bird from the previous year (2000-017; Rogers and Jaramillo 2002).

RED-FOOTED BOOBY *Sula sula* (13, 1). A brown-morph bird was 160 n. miles off San Diego, SD (31° 65′ N, 119° 95′ W), 14 Oct 2000 (NC; 2001-024). Its red feet and blue bill indicated a bird at least two years old.

TRICOLORED HERON *Egretta tricolor* (29**, 1). An immature was in Chula Vista, SD, 14 Oct 1999 (GMcC; 2001-161). An adult at the Tijuana R. estuary, SD, 24 Aug 2000–10 Jan 2001 (KMB, MGM; 2000-141) was considered a returning bird (same as 2000-002, Rogers and Jaramillo 2002) that first appeared as an immature in the winter of 1997–1998 (Rottenborn and Morlan 2000).

*REDDISH EGRET *Egretta rufescens* (80, 1). A returning adult at Imperial Beach, SD, 26 Aug 2000–24 Jan 2001 (GMcC; KMB, MGM; 2000-115; same as 1999-083, Rogers and Jaramillo 2002) was the individual with a slightly deformed bill that first appeared in 1982 (Roberson 1986). An immature was at San Elijo Lagoon, SD, 11–24 Sep 2000 (DT; MGM, AMa†, GMcC; 2000-120). The CBRC voted to remove this species from the review list at the 19 Jan 2002 meeting. Members supporting this change felt that coastal San Diego County is at the edge of the species' normal wintering range and that its pattern of occurrence there is well established. The species has nested as close to California as I. Todos Santos, Baja California, since 2000 (*N. Am. Birds* 55:352).

YELLOW-CROWNED NIGHT-HERON *Nyctanassa violacea* (18, 0). A returning adult was at La Jolla, SD, 9–10 Apr 2000 (2000-074; AME; GMcC; same as 1998-083, Erickson and Hamilton 2000), where it first appeared in 1981 (Binford 1985).

GLOSSY IBIS *Plegadis falcinellus* (1, 1). A well-documented adult in alternate plumage W of Calipatria, IMP, 1–15 Jul 2000 (PAG; GMcC, KZK†; 2000-096) represents the first accepted record of this species in the state, although one record from earlier that year is still in circulation. Details of the facial pattern distinguishing the Glossy from the White-faced Ibis (*P. chihi*) were well illustrated in the photographs and descriptions. Patten and Lasley (2000) published a photograph of the bird and discussed this identification problem and the westward expansion of the Glossy Ibis in the North America. Two other reports from the Imperial Valley in 2000 are still under review as the CBRC attempts to address the identification of basic-plumaged birds, the possibility of White-faced × Glossy Ibis hybrids, and questions of date spans. Another report was received from Santa Clara and Alameda counties in 2001 (*N. Am. Birds* 55:352). Details of these records will appear in future reports.

BLACK-BELLIED WHISTLING-DUCK *Dendrocygna autumnalis* (19, 3). One was near Obsidian Butte at the Salton Sea, IMP, 29 Apr 2000 (TEB†; 2000-076). Most records are from summer and fall; the only other record before late May was of a flock of nine birds at Finney L., IMP, 20 Apr 1990 (Patten and Erickson 1994). Two adults were on the SW shore of the Salton Sea, IMP, 27 May–22 Jun 2000 (AKK†; HD†, KZK†, GMcC; 2000-090); a color photograph of them appeared in *N. Am. Birds* 54:432. Another was near Obsidian Butte, IMP, 19 Aug 2000 (VH; 2000-157). All were considered separate individuals, although it is possible that some of the same birds were involved in more than one record.

KING EIDER *Somateria spectabilis* (35, 1). A first-winter male was at the fish docks, Pt. Reyes, MRN, 23 Dec 2000–20 Jan 2001 (SK; KMB, LWC†, EDG†, RWL, CL, LML‡, GMcC, JM, EPa, DEQ, RS†, JW†; 2000-164).

SMEW *Mergellus albellus* (2, 1). An adult male on the Old R., SJ, 20 Jan–29 Feb 2000 (TR; MD‡, TLE, SH, WH, MSM, DN; 2000-036) was California's second. The Committee voted unanimously to accept the bird's natural occurrence, following the precedent of the first record, a male that spent the winters of 1981–82 through 1983–84 in Foster City, SM (Binford 1985, Roberson 1986). There was some disagreement about the prevalence of this species in captivity in western North

America, although it appears to be regular, at least in small numbers. The natural occurrence of a male in British Columbia was brought into question after a waterfowl collector reported to have lost one nearby, although the location of the bird was the same as that of a male present 1989–1990, at which time the collector had not lost any Smews (*N. Am. Birds* 46:304). Clearly, the natural occurrence of extralimital Smews, like most waterfowl, should be assessed cautiously.

MISSISSIPPI KITE *Ictinia mississippiensis* (29, 1). A brief description of one at Lucerne Valley, SBE, 12 Jun 2000 (JE; 2000-094) portrayed the bird catching and eating insects on the wing, a behavior shared by few North American raptors. This behavior, combined with general plumage details, left nine members comfortable with the identification. The lone dissenter felt that a Plumbeous Kite (*I. plumbea*) was not eliminated. Another CBRC member familiar with that species felt that the described pale head better fit the Mississippi and that the pale tail bands and orange primaries of Plumbeous would not have been overlooked in the close view reported. Bevier (1990) discussed a previous Mississippi Kite record that received a 9–1 vote for similar reasons. The Plumbeous Kite is a common species in Central and South America that has been known to overshoot its normal range during spring migration in Argentina (Jaramillo 2000), but it has never been recorded north of southern Tamaulipas in Mexico and is unknown from western Mexico (AOU 1998).

HARRIS'S HAWK *Parabuteo unicinctus* (8**, 2). A molting adult was at Riverside, RIV, 27 Jun–23 Jul 1995 (MAP†; 1996-080F), and two were at Santee, SD, 26 Nov 1994–29 Jan 1995 (SEF, EDG†, CAM, GMcC, JM, MMR†, DSS, DGY; 1996-080C). Patten and Erickson (2000) had a strong influence on the Committee's treatment of this species, but they considered both of these records "debatable" in terms of natural occurrence. Each finally received a 9–1 vote on its fourth circulation.

WILSON'S PLOVER *Charadrius wilsonia* (9, 1). A male in first alternate plumage at Coronado, 5 May 2000 (RP; TRC, GMcC; 2000-080), provided San Diego County's fourth record.

EURASIAN DOTTEREL *Charadrius morinellus* (7, 1). Nine CBRC members considered the description of a bird at Southeast Farallon I., SF, 22 Aug 2000 (DGa; 2001-026) adequate to identify the bird to species. Details suggested a bird in juvenal plumage but did not allow for certain age determination.

HUDSONIAN GODWIT *Limosa haemastica* (18, 2). One was at Alviso, SCL, 26–31 May 2000 (AJ; LCh, MH, NL, RWR, MMR†, SBT; 2000-088). The limited alternate feathering suggested a bird in first alternate plumage, but the sex was uncertain. A juvenile was near Goose L., MOD, 14 Oct 2000 (JTr; 2001-140).

BAR-TAILED GODWIT *Limosa lapponica* (28, 2). An adult male was at the San Diego R. mouth, SD, 4–5 Sep 2000 (DVB†, CGE, GMcC, MSM; 2000-117). A juvenile was at Southeast Farallon I., SF, 25 Aug–23 Sep 2000 (JTi†; RDB†, PP; 2001-015). Both showed characters of the expected Asian subspecies *L. l. baueri*.

WHITE-RUMPED SANDPIPER *Calidris fuscicollis* (15, 1). An alternate-plumaged bird at China L., KER, 25–29 May 2000 (SS, RS†; JLD; 2000-099; Figure 3) fit the expected pattern of spring migrants in late May to mid June, which provide two-thirds of our accepted records.

CURLEW SANDPIPER *Calidris ferruginea* (26, 1). A juvenile was on the Santa Ana R. between Huntington Beach and Costa Mesa, ORA, 21–24 Nov 2000 (MD†, RF, MSM, MP‡, RWR, JW†; 2000-147). This exceptionally late record exceeded the previous late date by 23 days.

LITTLE GULL *Larus minutus* (77, 1). An adult was at Alviso, SCL, 21 Apr 1999 (SCR; 2001-040).

LESSER BLACK-BACKED GULL *Larus fuscus* (19, 1). One at Red Hill, Salton Sea, IMP, *16 Sep*–24 Oct 1999 (BMu; KCM, MAP, GMcC; 1999-176) appeared to be in its fourth prebasic molt. The rectrices showed some black in September and were all white by late October, but the outer primaries still lacked white mirrors, and it was unclear whether these feathers had been molted by that time. An adult with one or two small mirrors appeared at Obsidian Butte, IMP, 21 Nov 1999 (GMcC; 1999-194) and was unanimously considered the same individual, having completed its fourth prebasic molt. The same adult returned to Salton Sea N.W.R., IMP, 30 Sep–13 Oct 2000 (GMcC; 2000-123). Another returning adult was at Salton Sea State Recreation Area, RIV, 25 Jan–17 Mar 2000 (PJ; DSP, ARS; 2000-050; same as 1998-025, Erickson and Hamilton 2001). In N. California, returning adults were at Alviso, SCL, 8 Oct 2000 (JMa; 2000-125; same as 2000-140, Rogers and Jaramillo 2002) and L. Cunningham, SCL, 29 Oct 2000–9 Mar 2001 (MMR†; MWE; 2000-139; same as 1999-188, Rogers and Jaramillo 2002).

LONG-BILLED MURRELET *Brachyramphus perdix* (7, 1). One in basic plumage was seen and photographed from a boat at the entrance to Bodega Harbor, SON, 10 Sep 2000 (LH, DEQ†, MSM†; 2000-132). The brownish wings indicated a bird one year old. See also Records Not Accepted.

RUDDY GROUND-DOVE *Columbina talpacoti* (72, 2). Females at Furnace Creek Ranch, INY, 10 Jul 2000 (MJSM; 2000-107) and 9–22 Oct 2000 (MSM†, JLD; 2000-151) may have involved the same individual.

BLACK-BILLED CUCKOO *Coccyzus erythropthalmus* (15, 0). An accepted record from Big Sycamore Canyon, VEN, 24 Sep 1974 (HLJ; 1980-235A; Binford 1985) was reconsidered. A majority vote is required to overturn an accepted record, but only two members voted against its continued acceptance.

Figure 3. White-rumped Sandpiper, *Calidris fuscicollis*, at China Lake, Kern County, 26 May 2000.

Photo by Robert Steele

BROAD-BILLED HUMMINGBIRD *Cynanthus latirostris* (56, 1). A female was at Upper Otay Lake, SD, 12 Dec 1999-10 Mar 2000 (GM, DGr†; 2001-145).

XANTUS'S HUMMINGBIRD *Hylocharis xantusii* (2, 0). Like the cuckoo record above, this one, of an adult male at Yaqui Wells, SD, 27 Dec 1986 (RK; 1987-174A), was accepted previously (Hainebach 1992, Pyle and McCaskie 1992) and withstood reanalysis. The three members voting against the record in the second circulation emphasized that the only first-hand information from the observer was written over two years after the observation, that although reported to local "birders" in the area, the sighting was not reported in a more typical fashion until four days later, that CBRC members had no first-hand, or even direct second-hand, knowledge of the observer, that despite having seen the species before, the observer did not identify the bird until after the observation was over, and that the first record for the United States should be unassailable.

GREATER PEWEE *Contopus pertinax* (34, 1). One at Bonsall, SD, 2 Dec 2000 (PAG; 2001-010) was the tenth recorded in the county.

ALDER FLYCATCHER *Empidonax alnorum* (4,2). An immature female at Southeast Farallon I., SF, 2 Sep 1987 (PP†, RPH; 1993-098; #CAS 85542) and an unsexed immature banded there 27 Aug 1988 (PP†; 1993-102; Figure 4) preceded the two other accepted records for California (singing birds in Kern County 11 July 1991 and 30 May 1992; Patten et al. 1995, Heindel and Garrett 1996). The records fared poorly on their first circulations in 1994 and were placed on hold. Record 1993-098 received unanimous support on its second circulation in 2001; 1993-102 was accepted on its third circulation in 2002, with one member expressing concern that the eastern subspecies of the Willow Flycatcher (*E. traillii traillii* and *E. t. campestris*, often considered synonymous) was not conclusively eliminated.

The turnaround in these records was due to commentary and unpublished data provided by Philip Unitt. Unitt used an electronic colorimeter to quantify comparisons with a series of Alder and Willow flycatcher specimens. Alder Flycatchers, and the Farallon specimen, are greener on the crown and back than Willow Flycatchers and lack the head/back contrast typical of the Willows. Juvenile Alder Flycatchers and the Farallon specimen have yellowish wingbars, not the ochre of the western subspecies of the Willow. The wings of the Farallon bird are long and pointed even for an Alder Flycatcher. Eastern Willow Flycatchers are more similar to the Alder than are western Willows (subspecies *brewsteri, adastus,* and *extimus*), but the Farallon specimen fell outside the range of all Willow Flycatchers.

In-hand photos of the banded bird show upperpart and wingbar colors typical of a juvenile Alder Flycatcher, according to Unitt. Likewise, the wing chord (74.3 mm) and pointed wings (difference between the longest primary and P6 and P5 were 6.3 and 10.5 mm, respectively) would be extreme for the eastern Willow Flycatcher.

DUSKY-CAPPED FLYCATCHER *Myiarchus tuberculifer* (60, 5). Birds at Año Nuevo State Reserve, SM, 2 Jan–7 Feb 2000 (PJM, RST, AW†; 2000-064), Fountain Valley, ORA, 10 Jan–27 Feb 2000 (BEE, LDT; MD‡, KSG†, RAH, GMcC, JM, MJSM; 2000-039), and 3 miles SW of Brawley, IMP, 23 Mar 2000 (GMcC; 2000-069) brought to four the number of accepted records for the 1999–2000 season (cf. Rogers and Jaramillo 2002). Additional birds were at Golden Gate Park, SF, 1–12 Nov 2000 (KM; SJD†, MWE, JM; 2000-159) and Santa Barbara, SBA, 10 Dec 2000–6 Jan 2001 (DC; JLD, HR; 2000-011).

NUTTING'S FLYCATCHER *Myiarchus nuttingi* (1, 1). One in Irvine, ORA, 11 Nov 200–26 Mar 2001 (LDT; MBi, AB, JB, MD†, DDesJ†, JLD, BEE†§, DRF†, RF, KLG, LML‡, MJM, MM, GMcC, JM, RWR, MMR, MJSM, MSM†, MP‡, LS†, JW†; 2000-161; Figure 5) was seen by hundreds; another photograph appeared on the cover of *W. Birds* vol. 32, no.1. From his examination of the bird's molt pattern, Pyle (in comments) identified it as probably an immature. Patten (in comments), initially

concerned about the limited rufous in the rectrices (the bird was first identified as a Dusky-capped Flycatcher for this reason), examined specimens at WFVZ, emphasized the amount of variation in rectrix pattern in this species (cf. Howell and Webb 1995), and wondered if there may be a taxonomic basis for it. Nutting's Flycatcher, resident on the Pacific slope from northern Mexico to Costa Rica, has been recorded only twice in Arizona (ABA 2002) and so was unexpected in California.

THICK-BILLED KINGBIRD *Tyrannus crassirostris* (15, 0). Adults returned to the campus of California State Polytechnic University Pomona, LA, 29 Oct–23 Dec 2000 (MSM; JeH; 2000-152; ninth winter; Erickson and Terrill 1996, Rogers and Jaramillo 2002) and to Half Moon Bay, SM, 10 Dec 2000–27 Mar 2001 (PJM, JM; 2001-063; third winter; Erickson and Hamilton 2001, Rogers and Jaramillo 2002).

WHITE-EYED VIREO *Vireo griseus* (40, 1). A singing male was along the Sweetwater River in the Otay–Sweetwater Unit of San Diego N.W.R., Spring Valley, SD, 5–15 Jul 2000 (PAG, GMcC, AMe†, GLR; 2000-108).

BLUE-HEADED VIREO *Vireo solitarius* (9**, 3). A singing male at Huntington Beach, ORA, 13 May 2000 (MD‡, RF, JM; 2000-081) provided the first spring record accepted by the CBRC. More typical were individuals at Pt. Reyes, MRN, 23 Sep 2000 (PS; 2001-122) and Southeast Farallon I., SF, 6 Oct 2000 (JT†; 2001-027).

YELLOW-GREEN VIREO *Vireo flavoviridis* (71, 5). Five accepted records in October 2000 were typical of recent years (Rogers and Jaramillo 2002): Montara, SM, 5 Oct 2000 (AJ; 2000-124); San Gregorio Creek, SM, 6 Oct 2000 (RST; 2001-042); Oceano, SLO, 8 Oct 2000 (DDiT; 2001-050); Carmel R. mouth, MTY, 14–17 Oct 2000 (MMR; 2000-137); and the Oxnard Plain, VEN, 20–25 Oct 2000 (RAH; AB, DVP; 2000-145).

SEDGE WREN *Cistothorus platensis* (6, 1). A record of one in Saline Valley, INY, 12 Nov 1999 (REM; 2000-005) reached unanimous approval on its third circulation. It furnished the second interior record, the first for fall. Coastal records span 15 Oct–8 Nov.

BLACK-BACKED WAGTAIL *Motacilla lugens* (10, 1). An adult male at Alviso, SCL, 17 Dec 2000–7 Apr 2001 (DMcI; LCh, LWC, AJ, MJM, JM, BP, RWR, MMR†, SBT†; 2000-160; Figure 6) did not present the identification challenge that other age/sex classes do and was the second known to have wintered in California.

SPRAGUE'S PIPIT *Anthus spragueii* (28, 1). One was in Saline Valley, INY, 30 Oct 1999 (REM; 2000-006).

GOLDEN-WINGED WARBLER *Vermivora chrysoptera* (63, 3). A singing male was at Pt. Reyes, MRN, 4 Jun 2000 (LJE; KB, MH, KCK; 2000-087), another male was at the South Fork Kern River Preserve, KER, 3 Aug 2000 (PH; 2001-051), and a female was at Lompoc, SBA, 23 Nov 2000–2 Mar 2001 (BKH†; KB, LWC, DC, JLD, GEP, SBT; 2000-162). Although there were up to five "winter" records, the species had not been documented previously in the month of January; April is now alone without a record. There were only two previous August records.

PINE WARBLER *Dendroica pinus* (61, 3). One at the University of California campus, Riverside, RIV, 1 Oct 1987 (DAG, EWA; 1988-052A) was accepted previously (Pyle and McCaskie 1992) and withstood reanalysis with a vote of 8–2. Its date now stands as the earliest in fall for the state, as two September records accepted previously were overturned during reconsideration (see Records Not Accepted). Three recent records included two at El Dorado Park, Long Beach, LA (fourth consecutive winter there): a male 9 Nov–29 Dec 2000 (RWR, MSM; 2000-149) and an unsexed bird 11 Nov–29 Dec 2000 (MSM; 2001-002), and a male in Santa Ana, ORA, 28 Dec 2000–3 Mar 2001 (DRW; RF, JM; 2001-037).

WORM-EATING WARBLER *Helmitheros vermivorus* (89, 2). One at Huntington Beach, ORA, 2 Jan–16 Mar 2000 (KSG; 2000-070) was the second of two birds wintering there that season (Rogers and Jaramillo 2002). Another was at Montecito, SBA, 26 Dec 2000 (JEL; DC; 2001-065).

LOUISIANA WATERTHRUSH *Seiurus motacilla* (14, 4). Four individuals in two or three seasonal roles made 2000 an exceptional year. Single birds were at Huntington Beach, ORA, 30 Apr 2000 (DRW; 2000-116), Southeast Farallon I., SF, 7 Sep 2000 (RDB; 2001-017), Yucca Valley, SBE, *18*–22 Sep 2000 (SK; VH, MAP; 2000-122), and Lompoc, SBA, 23 Nov–6 Dec 2000 (BKH‡; DC; 2001-009). Patten and Marantz (1996) discussed the recent increase in records of this and other southeastern wood warblers.

CONNECTICUT WARBLER *Oporornis agilis* (85, 3). Individuals were at Ridgecrest, KER, 7 Sep 1999 (JAS; 2000-049), Southeast Farallon I., SF, 3 Sep 2000 (JT†, RDB; 2001-018), and Galileo Hill Park, KER, 7 Sep 2000 (KSG†; MSM; 2000-131). Although most records are for September, only five have been as early in the month as these.

SCARLET TANAGER *Piranga olivacea* (103, 2). Because of its unseasonal date, California's third accepted record, from Dana Point, ORA, 23 Aug 1964 (GMcC, EAP; 1986-108A; Roberson 1993), was reconsidered but ultimately reaffirmed. Although the plumage description was marginal, the voice description ("chip-burr" call note) was considered diagnostic by most members. Several Committee members suggested the bird summered in southern California, as fall records range from 14 Sep to 13 Dec, with only five records for September. Typical were individuals at Pt. Loma, SD, 5 Oct 2000 (GMcC; 2000-126) and Wilmington, LA, 26–29 Oct 2000 (MSM; 2000-153).

CASSIN'S SPARROW *Aimophila cassinii* (41, 1). An immature at Southeast Farallon I., SF, 10 Oct 2000 (JT, RDB, PP†; 2001-016) was the twelfth to be recorded at that famous location.

FIELD SPARROW *Spizella pusilla* (7, 1). One at Furnace Creek Ranch, INY, 5 Oct 2000 (ADeM; 2001-013) represented only the third typical fall vagrant record for California, all from Inyo and Kern counties.

SNOW BUNTING *Plectrophenax nivalis* (70, 2). Immature males were at Southeast Farallon I., SF, 13 Nov 2000 (PP; 2001-029) and Año Nuevo State Reserve, SM, 15–20 Nov 2000 (GJS†; 2001-022).

PAINTED BUNTING *Passerina ciris* (82,9). The nine accepted records from 2000 were more than for any previous year, and documentation for nine more records published in *N. Am. Birds* (55:101, 105) has yet to be submitted to the CBRC. The frequency of records in Arizona has increased as well (*N. Am. Birds* 55:466). Single green-plumaged birds were at Big Pine, INY, 20–21 Aug 2000 (imm. male; JoH, TH; 2001-003; #LACM 111517); Big Pine, INY, 21 Aug 2000 (JoH, TH; 2001-061); Furnace Creek Ranch, INY, 27 Aug 2000 (MSM; 2000-130); Baker Creek Meadows, INY, 30-31 Aug 2000 (SH; JLD, JoH, TH; 2000-118); Pilarcitos Creek, SM, 13 Sep 2000 (RST; 2001-041); Southeast Farallon I., SF, 26 Sep 2000 (PC†; 2001-030); Galileo Hill Park, KER, 30 Sep–1 Oct 2000 (DSC; MF, NF, LS†; 2001-043; Figure 7); Ragged Pt., SLO, 2 Oct 2000 (WB; 2001-049); and W of Calipatria, IMP, 6 Oct 2000 (GMcC; 2000-127).

COMMON GRACKLE *Quiscalus quiscula* (51,3). Individuals were near Agua Caliente Springs, SD, 14 Apr 2000 (DS†, JEH, GCH; 2000-092), at Pt. Sur, MTY, 16 Nov 2000 (LCo†; 2000-163), and on Southeast Farallon I., SF, 19 Nov–*8 Dec* 2000 (PP†; 2001-031). Details of a second bird reported at Pt. Sur (*N. Am. Birds* 55:100) have not been submitted to the CBRC.

RECORDS NOT ACCEPTED, IDENTIFICATION NOT ESTABLISHED

ARCTIC LOON *Gavia arctica*. One in basic plumage was reported at the Ventura R. mouth, VEN, 2 Jan 2000 (2000-144). Although the bird was described as having white flank patches, many details were lacking. Observers should carefully describe all features that differ from the similar Pacific Loon (*G. pacifica*; see Reinking and Howell 1993, Birch and Lee 1997) while ensuring that other loon species are also eliminated (cf. Rottenborn and Morlan 2000).

YELLOW-BILLED LOON *Gavia adamsii*. One in juvenal plumage was reported at Monterey, MTY, 27 Feb 2000 (2000-144). Although the description of the large ivory bill and warm brown upperparts with whitish feather edges supported the Yellow-billed, important specific details of bill shape and head pattern were not noted. Observers should make careful note of the exact culmen and lower mandible shape on suspected Yellow-billed Loons, as descriptions such as "upturned bill" lack the level of detail desired by most CBRC members.

MARKHAM'S STORM-PETREL *Oceanodroma markhami*. One was tentatively identified 28 n. miles W of Fort Bragg, MEN (39° 32.09′ N, 123° 23.40′ W), on 19 Aug 2000 (2000-154). Markham's is one of several large dark Pacific species of *Oceanodroma* that are difficult to separate at sea. A Markham's was seen 293 n. miles WSW of San Nicolas I., VEN, on 27 July 1991 (Pyle 1993), and it has often been considered a potential visitor to California waters. The Fort Bragg bird exhibited most of the known field marks for this species (outlined by Brown 1980, Harrison 1983, and Pyle 1993), including brownish plumage, narrow distinct bars extending onto the carpal area, shallow wingbeats, high-arcing flight, all-dark rump, and long tail. However, the sighting was rather brief (1–2 minutes), and sea conditions were not ideal. Observers of the bird, being familiar with the similar Black (*O. melania*) and Tristram's (*O. tristrami*) storm-petrels, were confident that it was not one of those two species, but no one on board had experience with significant numbers of Markham's. Most CBRC members felt that more tangible evidence or a longer, more complete view would be necessary to add this species to the state list.

BROWN BOOBY *Sula leucogaster*. A report from Newport Pier, ORA, 11 Jan 2000 (2000-085) was supported by a brief description and several simple sketches, which conveyed the correct general pattern for an adult Brown Booby. Although the majority of the Committee supported the record on the first circulation, only four members endorsed its identification on the second circulation, mainly because of the sparse details and concern that a Masked or Nazca Booby was not eliminated. The CBRC continues to struggle with sparsely detailed reports of white-bellied "brown" boobies, as all four species recorded in California share this general pattern in some plumages. Careful description of the exact pattern on the throat and breast, as well as the underwings, should alleviate this problem (cf. Harrison 1987). Two birds described at the New R. mouth, Salton Sea, IMP, 6 Mar 2000 (2000-059) failed to receive the necessary support on the second round; most members were not convinced that the described birds were indeed boobies.

TRICOLORED HERON *Egretta tricolor*. A brief description of a heron at the Whitewater R. delta, RIV, 16 Jun 2000 (2000-097) failed to gain acceptance. Several Committee members were concerned that a Little Blue Heron (*E. caerulea*) was not eliminated.

WHITE IBIS *Eudocimus albus*. A bird seen in flight from a moving vehicle on Highway 99 north of Maxwell, COL, 1 Jul 2000 (2000-102) was not supported, although most members felt that it could have been a White Ibis. Interestingly, Oregon and Washington both received their first records of this species in Nov/Dec 2000 (*N. Am. Birds* 55:94, 220).

MASKED DUCK *Nomonyx dominicus*. The descriptions of a duck at Mecca, RIV, 29 Feb 2000 (2000-058) fit the general characteristics of this species, but most members felt the details were insufficient to establish a first state record. Several members were concerned that the behavior of swimming in the open, away from thick vegetation, would be unusual for this species. In addition, other observers reported a melanistic Ruddy Duck (*Oxyura jamaicensis*) bearing a superficial resemblance to a male Masked Duck from the same location.

COMMON BLACK-HAWK *Buteogallus anthracinus*. One was reported in Santa Rosa, SON, 14 Oct 2000 (2000-156) by an experienced observer. The two accepted records of this species are from Riverside County in April and May (Daniels et al. 1989, Rottenborn and Morlan 2000). This report from far north of the species' range was unexpected. Although most details supported this species, CBRC members were variously concerned over the elimination of the Zone-tailed Hawk (*Buteo albonotatus*), Great Black-Hawk (*Buteogallus urubitinga*), and Solitary Eagle (*Harpyhaliaetus solitarius*). The last two species would be surprising anywhere in California, but the possibility of non-natural occurrence was considered. Some members felt that the described call note and behavior (it was eating a Western Meadowlark, *Sturnella neglecta*) better fit a Zone-tailed Hawk. Members supporting the identification felt the natural occurrence was questionable.

CRESTED CARACARA *Caracara cheriway*. A brief description of a bird perched atop a snag in the Antelope Valley, SIE, 15 Jun 2000 (2000-104) was accompanied by a tape recording of a Clark's Nutcracker (*Nucifraga columbiana*) and received no support.

UPLAND SANDPIPER *Bartramia longicauda*. A bird heard calling over Rush Creek, MNO, 30 May 2000 (2000-103) was tentatively identified as this species. While some Committee members felt that an Upland Sandpiper was likely involved, most were uncomfortable with voice-only records of this species. In addition, several members felt that the call as described could have come from a Long-billed Curlew (*Numenius americanus*).

WOOD SANDPIPER *Tringa gareola*. A juvenile was reported near Mare I., SOL, 22 Sep 2000 (2001-104). Although the distinct supercilium and boldly patterned underparts suggested this species and most CBRC members felt the identification was likely correct, a few critical details were not noted. In addition, some members were concerned that the described structure and leg color of the bird did not fit their experiences with this species. The Wood Sandpiper is a small *Tringa* with an upright posture and short bill; several members commented that its structure is more reminiscent of a small Lesser Yellowlegs (*T. flavipes*) than a Solitary Sandpiper (*T. solitaria*), the North American species closest in plumage. The legs of Wood Sandpipers are usually yellowish, differing from the olive-gray of the described bird and most Solitary Sandpipers. The rump and underwings were not seen, and no vocalizations were heard. Considering these difficulties, the Committee felt that the single-observer report was not sufficient to establish a first state record, although some members expect that this species will eventually be documented in California.

RED-NECKED STINT *Calidris ruficollis*. Single-observer reports of adults at the Santa Ynez R. mouth, SBA, 13 Jul 2000 (2001-052) and Bolsa Chica, ORA, 5 Aug 2000 (2001-062) failed to receive adequate support. Although the accompanying descriptions suggested this species, both were based on rather brief periods of observation and lacked important details. The identification of stints should always be approached with caution; sight records without exhaustive details are unlikely to be supported.

WHITE-RUMPED SANDPIPER *Calidris fuscicollis*. One was reported at Lodi,

SJ, on the extremely early date of 21 Apr 2000 (2000-075). The description mentioned a white rump and other suggestive characteristics, but most members were unwilling to endorse a single-observer record in April without highly detailed documentation.

BAND-TAILED GULL *Larus belcheri*. A controversial record of a gull identified as this species on San Nicolas I., VEN, 9 Nov 1987–23 Feb 1988 originally was not accepted (Heindel and Garrett 1995). It was resubmitted (1988-076A) after the acceptance of a widely seen Band-tailed Gull in San Diego (Rottenborn and Morlan 2000). After four rounds, the San Nicolas bird again failed to gain acceptance. Although the identification is supported by a sketch and brief written description that suggest this species, a minority of the Committee felt that a sight record of this significance should be supported by more extensive details or the corroboration of other observers.

ICELAND GULL *Larus glaucoides*. A record of a juvenile at the Santa Clara R. estuary, VEN, 18 Jan 1991 (1991-168A) was tabled after receiving a 2–8 vote on its first circulation (see Rottenborn and Morlan 2000). The Committee reconsidered it in order to judge whether it was acceptable on the basis of the CBRC's latest understanding of this species' identification and taxonomy. Supported by two photographs, the record received three and one "accept" votes, respectively, on its first and second circulations following resubmittal. Committee members were split on the question of whether it belonged to the Iceland/Thayer's (*L. thayeri*) Gull complex. Some felt it more closely resembled a hybrid Glaucous × Herring Gull (*L. hyperboreus* × *L. argentatus*). Most agreed, however, that the bird could not be identified with certainty without written details or photos addressing the spread wing and tail patterns. Hybrids can closely resemble Iceland and Thayer's gulls in both plumage and structural features, and only small-billed, round-headed female Iceland/Thayer's are likely to avoid this controversy. Howell and Corben (2000a) discussed this problem in greater detail.

SLATY-BACKED GULL *Larus schistisagus*. A gull apparently near the end of its fourth prebasic molt at Salton City, IMP, 21 Feb–7 Mar 1998 (1998-050; Figure 8) barely failed to gain acceptance on the fourth and final round. This record was supported by a series of photographs and written descriptions from a number of experienced observers, including several CBRC members. Although most of the features evident on the bird were within the range of variation of this species, a few points did not fit the CBRC's expectations of a "classic" Slaty-backed Gull, and two members felt that the addition of this species to the state list should not be based on such a bird. Asian experts reported that most Slaty-backed Gulls have completed their primary molt by December, but supporters of the record pointed out that some gull species can delay their molt considerably in unusual circumstances (cf. Howell and Corben 2000b). Several later-molting Asian taxa, especially *L. fuscus heuglini*, caused concern, especially with regard to the limited knowledge of the extent of hybridization involving these forms. This bird's leg color, somewhat paler than the dark pink normally associated with this species, and the width of the white trailing edge of the wings, which was variously regarded as supportive or damaging, were further considerations that left two members believing that the bird was best left unidentified. Goetz et al. (1986), Gustafson and Peterjohn (1996), King and Carey (1999), and various other authors have described and debated variation in this species.

SANDWICH TERN *Sterna sandvicensis*. A report from Los Angeles, LA, 21–23 Jun 2000 (2000-106) was supported by brief written details. The CBRC felt that a hybrid Sandwich × Elegant (*S. elegans*) Tern was not eliminated. Indeed, an apparent hybrid was present nearby on 26 Jun 2000 (*N. Am. Birds* 54:423). Collins (1997) described apparent hybridization between these two species in California.

BRIDLED TERN *Sterna anaethetus*. A report from three observers at Bolsa Chica, ORA, 12 Jun 1993 (1993-144A) was formerly not accepted as the state's first Bridled Tern (Erickson and Terrill 1996). It was resubmitted after the acceptance of a Bridled Tern from the same location in 1998 (Erickson and Hamilton 2001). In two further circulations, the Committee continued to express concern over the elimination of the Gray-backed Tern (*S. lunata*), a species of the tropical Pacific that breeds as close as the Hawaiian Islands. Gray-backed Terns are normally clear gray on the back and upperwings, with contrastingly darker primaries and secondaries. McKee examined heavily worn Gray-backed Terns at Midway Atoll at the beginning of their prebasic molt in August and found that a slightly darker, brownish cast developed on the outer secondary coverts, but the inner coverts and back remained medium gray, readily distinguishable from the dark brown of the Bridled. In addition, Gray-backed Terns maintained a distinct contrast between gray tertials and blackish primaries, which is less obvious in the Bridled. Although the written descriptions of this individual better fit the Bridled, most CBRC members felt that the views of the bird were insufficient to establish a record of this significance. Harsh lighting can easily complicate judgment of gray and brown shades, particularly on distant birds. Various authors' descriptions of the back and wing color of the Gray-backed vary widely (cf. Mostello et al. 2000), underscoring the subjectivity of this assessment, even on museum specimens.

LONG-BILLED MURRELET *Brachyramphus perdix*. Reports of one in basic plumage just off Pt. St. George, DN, 14 Jul 2000 (2000-100) and one largely in alternate plumage 2 km. off L. Earl, DN, 5 Aug 2000 (2000-112) were accompanied by brief descriptions from a highly experienced murrelet surveyor. Although most of the important features used to distinguish this species from the Marbled Murrelet (*B. marmoratus*) were depicted, the majority of the CBRC felt that more extensive details were necessary for acceptance. All three accepted records of alternate-plumaged birds thus far have been of specimens from Mono L. in late summer (Rogers and Jaramillo 2002). Lethaby (2000) discussed the identification of birds in this plumage. Our four accepted records of birds in basic plumage have been along the coast between 29 Jul and 27 Dec (Rottenborn and Morlan 2000, Erickson and Hamilton 2001). The surprising resemblance of juvenile Pigeon Guillemots (*Cepphus columba*) to basic-plumaged Long-billed Murrelets complicates the identification of these birds. Relative size is difficult to judge on lone birds at sea and, indeed, experienced observers have confused these two species. Juvenile guillemots may not have fully developed bills by the time they are encountered at sea, and they show white mottling in the mantle. Care must be exercised to distinguish these features from the very thin bill and crisper, more solid white scapular lines of the Long-billed Murrelet.

KITTLITZ'S MURRELET *Brachyramphus brevirostris*. The identification of a bird near the north jetty of Humboldt Bay, HUM, 5 Sep 2000 (2000-119) rested on the apparently small bill, compared to the Marbled Murrelet. The CBRC considered this insufficient to establish such a rare occurrence.

RUDDY GROUND-DOVE *Columbina talpacoti*. The wing linings of a female reported at Ramer L., IMP, 5 Feb 2000 (2000-072) were described as chestnut, precluding the Ruddy Ground-Dove.

BLACK-BILLED CUCKOO *Coccyzus erythropthalmus*. There was no Committee support for a record of a bird heard only at Scotty's Castle, Death Valley N.P., INY, 26 May 2000 (2000-091).

YELLOW-BELLIED FLYCATCHER *Empidonax flaviventris*. Most members believed that one reported at Wilder Ranch S.P., SCZ, 14 Oct 2000 (2000-134) may have been correctly identified, but only two members voted to accept. Several members considered the observation too brief.

GREAT CRESTED FLYCATCHER *Myiarchus crinitus*. In the Committee's opinion, one reported from Pt. Loma, SD, 23 Sep 2000 (2001-005) was not seen well enough to confirm the identification.

YELLOW-THROATED VIREO *Vireo flavifrons*. One reported at Rancho Cucamonga, SBE, 2 Nov 2000 (2000-143) was described briefly and received only two accept votes.

BLUE-HEADED VIREO *Vireo solitarius*. One reported at Eureka, HUM, 3 Nov 1999 (1999-215) was seen rather briefly and described incompletely, but it enjoyed majority acceptance on its first two circulations before receiving a final tally of 4–6.

BLUE-WINGED WARBLER *Vermivora pinus*. One reported at Yucca Valley, SBE, 23 Sep 2000 (2001-006) was incompletely described.

GRACE'S WARBLER *Dendroica graciae*. One was reported at San Marcos, SD, 8 Oct 2000 (2001-007). What was apparently the same bird was later identified by others as a Blackburnian Warbler (*D. fusca*).

PINE WARBLER *Dendroica pinus*. Records from Southeast Farallon I., SF, 21 Sep 1973 (1973-084A) and Briceland, HUM, 25 Sep 1985 (1987-218A) were accepted previously by the Committee (Winter and McCaskie 1975 and Pyle and McCaskie 1992, respectively). Upon reconsideration, both received the required majority of votes to overturn the records on their second circulations. Most members allowed that these birds may have been correctly identified, but early seasonal records are reviewed with special caution; there are now no CBRC-accepted records for September.

WORM-EATING WARBLER *Helmitheros vermivorus*. The "reddish" breast described on a bird reported at the Cosumnes R. Preserve, SAC, 14 Oct 2000 (2000-128) was more than most Committee members could reconcile.

LOUISIANA WATERTHRUSH *Seiurus motacilla*. One reported near Blythe, RIV, 23 Sep 2000 (2001-168) received a single accept vote.

CONNECTICUT WARBLER *Oporornis agilis*. One reported at Goleta, SBA, 8 Oct 1999 (2000-028) generated lively debate and received four accept votes on each of two circulations through the Committee. The bird was not seen walking on the ground in the manner typical of this species.

MOURNING WARBLER *Oporornis philadelphia*. Reports from Pt. Reyes, MRN, 18 Sep 1999 (1999-153) and White Slough W.M.A., Lodi, SJ, 28 May 2000 (2000-093) received split votes on their first circulations but lost support thereafter. The Lodi bird was especially interesting. It was a male with weak eye crescents, pale lores, a black breast patch, and a song considered unlike MacGillivray's Warbler (*O. tolmiei*). Several members wondered about the possibility of hybridization with MacGillivray's, variously regarded as unproven (Dunn and Garrett 1997, Garrett in comments) or occurring rarely (Cox 1973, Hall 1979, Patten in comments).

SCARLET TANAGER *Piranga olivacea*. One reported from Sacramento, SAC, 8 Jan 2000 (2000-078) received a unanimous decision; there are no accepted winter records for California.

BAIRD'S SPARROW *Ammodramus bairdii*. Most CBRC members considered one reported from Pt. Reyes, MRN, 12–13 Jan 2000 (2000-048) likely to have been a Savannah Sparrow (*Passerculus sandwichensis*).

COMMON GRACKLE *Quiscalus quiscula*. Parkes (1999) criticized the CBRC's use of head color in not accepting one reported NW of Bishop, INY, 29 Sep 1993 (1993-186A; Garrett and Singer 1998), so the record was reconsidered. The record

failed to gain acceptance in two more circulations, on the basis of other inadequacies. Another bird reported from Los Banos, MER, 22 Oct 2000 (2000-135) was incompletely described.

RECORDS NOT ACCEPTED, NATURAL OCCURRENCE QUESTIONABLE (IDENTIFICATION ACCEPTED)

PINK-BACKED PELICAN *Pelecanus rufescens*. An adult shocked observers as it associated with Brown Pelicans (*Pelecanus occidentalis*) on Southeast Farallon I., SF, 22–24 Oct 2000 (JTi; IS†, RDB†; 2001-019; Figure 9). Most CBRC members felt that this species was highly unlikely to reach North America on its own, and commentary from outside experts supported captive origin. Small numbers of Pink-backed Pelicans are kept in captivity in the U.S., but captive waterbirds can be difficult to track, as they are not always banded or registered. The limited movements of this African species, and its questionable ability to cross a major ocean, weighed heavily against its natural occurrence. Members were intrigued, however, that the bird flew at least 32 km between the mainland and the island, and that it was in alternate plumage, suggesting that it had recently been in the Southern Hemisphere and perhaps supporting a recent migration of even longer distance.

DARTER *Anhinga melanogaster*. A female at Finney L., IMP, 17 Nov 1999 (LWC; 1999-210) and one at adjacent Ramer L., IMP, 19 Jun–13 Jul 2000 (SO, GMcC, KZK†; 1999-210; Figure 10) were considered the same individual, after creating considerable confusion. This bird was initially circulated as an Anhinga (*A. anhinga*), receiving considerable support as such. The bird was later refound and identified as the African subspecies of the Darter, *A. m. rufa*, sometimes considered a species separate from the Darters of Australia and Asia (AOU 1998, Johnsgard 1993). This species is kept in southern California zoos and should be considered carefully in the identification of apparent Anhingas (cf. McCaskie and San Miguel 1999). The CBRC felt that this species is an unlikely candidate for natural occurrence in California. Subsequent reports of Darters have come from San Diego County (P. Unitt pers. comm.) and Ensenada, Baja California (*N. Am. Birds* 56:111).

BLUE MOCKINGBIRD *Melanotis caerulescens*. An adult in Long Beach, LA, 5 Dec 1999–25 Mar 2000 (KSG, RAH; LWA, JWB, JLD, RF, KLG†, KCK, CAM, GMcC, JM, MP‡, WJP, MMR†, MSM†, MMT, JW‡; 1999-208; Figure 11) was seen by many observers and generated considerable debate. Most members believed it possible for this species to reach California naturally, but the record received only one accept vote in each of two circulations. Location, age, and the presence of a short white tenth primary (possibly suggesting a response to stress from prior captivity) all weighed against the record. The Blue Mockingbird is an endemic resident in Mexico with extralimital records for Arizona (AOU 1998). The origin of a long-staying individual in Texas has been controversial (*N. Am. Birds* 53:302, 56:73). On the basis of the Long Beach record, the Blue Mockingbird was added to the Supplemental List of California birds at the CBRC's January 2002 meeting.

PAINTED BUNTING *Passerina ciris*. Adult males were at Borrego Springs, SD, 31 Jul–1 Aug 1998 (LLJ†; 1998-182), Camarillo, VEN, 22–23 Oct 2000 (GS; CS†, WW; 2000-136), and Costa Mesa, ORA, 17–27 Nov 2000 (PO; 2000-150). A female was in Long Beach, LA, 13 Feb–22 Mar 2000 (LWC, KLG, KSG, GEP, MSM†, RSo; 2000-061). Only the Borrego Springs record had substantial support. It received the minimal vote for non-acceptance of 7–3 on its fourth and final circulation.

Figure 4. California's second Adler Flycatcher, *Empidonax alnorum*, on Southeast Farallon Island, San Francisco County, 27 August, 1988. See text for a discussion of characters used to distinguish this individual from the similar Willow Flycatcher *(E. traillii)*.

Photo by Peter Pyle

Figure 5. California's first Nutting's Flycatcher, *Myiarchus nuttingi*, in Irvine, Orange County, 23 December, 2000. Rufous in the rectrices was not so evident under most viewing conditions.

Photo by Larry Sansone

Figure 6. Adult male Black-backed Wagtail, *Motacilla lugens*, at Alviso, Santa Clara County, 17 December 2000.

Photo by Michael M. Rogers

CONTRIBUTORS

Larry W. Allen, Matthew Amalong, Eugene W. Anderson, Jonathan Ausubel, Thomas E. Benson, Clyde Bergman, Mark Billings (MBi), Andrew Birch, David V. Blue, Mel Bolindes, William Bouton, Robert S. Braden, Jean Brandt, Paul A. Buchanan, John W. Buckman, Ryan D. Burnett, Jim Burns, Kenneth M. Burton, Phil Capitolo, Les Chibana (LCh), Therese R. Clawson, Bruce Cohen, Luke W. Cole, Natalia Collier, Dave Compton, Lis Covello (LCo), Brian E. Daniels, Jeff N. Davis, Stephen J. Davies, Maya Decker, Al DeMartini (ADeM), Don DesJardin, Henry Detwiler, Ann Dewart, Dean DiTommaso, Jon L. Dunn, Bettina E. Eastman, Mark W. Eaton, Thomas M. Edell, Gavin Edmondstone, Leo J. Edson, Claude G. Edwards, Alan M. Eisner, Elias Elias, Theodore L. Eliot, Jeremy Ertl, David R. Ferry, John M. Finkbeiner, Shawneen E. Finnegan, Robbie Fischer, Mary Freeman, Nick Freeman, Wes Fritz, David Gardner (DGa), Kimball L. Garrett, Karen S. Gilbert, Peter A. Ginsburg, David A. Goodward, Edward D. Greaves, George Griffeth, David Griffin (DGr), Sue Guers, William E. Haas, Robert A. Hamilton, Steve Hampton, Sandra D. Harvill, Merry Haveman, Gjon C. Hazard, Norwood C. Hazard, Phil Heavin, Jo Heindel (JoH), Matthew T. Heindel, Tom Heindel, R. Philip Henderson, Roger Higson, Brad K. Hines, Waldo Holt, Charles Hood, Jeff Hopkins (JeH), Debbie House, Vernon Howe, Lisa Hug, Robbie Hunsinger, John E. Hunter, Alvaro Jaramillo, L. Louise Jee, Jerome A. Johnson, H. Lee Jones, Paul Jorgensen, Al K. Kalin, Richard Klauke, Sandy Koonce, Kenneth Z. Kurland, Keith C. Kwan, David Lemon, Joan E. Lentz, Nick Lethaby, George Levine, Norman G. Levine, Cindy Lieurance, Leslie M. Lieurance, Roger Linfield, Randy W. Little, Michael J. Mammoser, Curtis A. Marantz, John Mariani (JMa), Michael G. Mathos, Robert E. Maurer, Jr., Andrew Mauro (AMa), Guy McCaskie (GMcC), David McIntyre, Tristan McKee (TMcK), Kevin McKereghan, Anthony Merceica (AMe), Peter J. Metropulos, Brian Minshull, Kurt

Mize, Steven G. Mlodinow, Kathy C. Molina, William J. Moramarco, Joseph Morlan, Gretchen Morse, Brennan Mulrooney (BMu), Tom Murphey, Roger Muskat, David Nelson, Kristie Nelson, Paula Oberstein, Stan Olsen, Ed Pandolfino (EPa), Benjamin D. Parmeter, Michael A. Patten, Robert Patton, Gary E. Peebles, Dharm S. Pellegrini, David Pereksta, Robert L. Pitman, Molly Pollock, Jude Claire Power, Eric Preston (EPr), William J. Principe, Eleanor A. Pugh, Peter Pyle, David E. Quady, Hugh Ranson, Robert W. Reiling, Coady Reynolds, Don Roberson, Geoffrey L. Rogers, Michael M. Rogers, Terry Ronneberg, Stephen C. Rottenborn, Richard A. Rowlett, Ronald M. Saldino, Ivan Samuels, Mike San Miguel, Michael J. San Miguel, Jr., Larry Sansone (LaS), Paul Saraceni, Lilian Saul (LiS), Joyce A. Seibold, Brad Sillasen, Daniel S. Singer, Cork Smith, Grace Smith, Susan E. Smith, David Solis, Andrew R. Spencer, Rich Sonnenberg (RSo), Rich Stallcup (RS), Robert Steele (RSt), Susan Steele, Gary J. Strachan, Robert Sutherland (RSu), Monte M. Taylor, Scott B. Terrill, Ronald S. Thorn, Jim Tietz (JTi), Larry D. Tripp, David Trissel, John Trochet (JTr), Steve Tucker, David Vander Pluym, Doug Wassmer, Walter Wehtje, Joel Weintraub, Douglas R. Willick, Adam Winer, David G. Yee, James O. Zimmer.

ACKNOWLEDGMENTS

This report would not have been possible without the 190 observers who submitted reports to the Committee. Geoff Carey, David Fisher and the Seychelles Bird Records Committee, Jon R. King, Douglas J. Long, Peter Milburn, Tony Palliser, Bruce Peterjohn, Lindsay E. Smith, and Philip Unitt provided helpful commentary on some of the records in this report. Committee members Cole, Dunn, Garrett, Hamilton, McCaskie, Morlan, Patten, Pyle, Rogers, and San Miguel provided helpful comments on the manuscript. Peg Stevens and Jon C. Fisher continued to archive the Committee's materials at WFVZ. H.T. Harvey and Associates, San Jose, hosted the 2002 meeting. We extend our thanks to all.

LITERATURE CITED

American Birding Association. 2002. ABA Checklist, Birds of the Continental United States and Canada, 6th ed. Am. Birding Assoc., Colorado Springs, CO.

American Ornithologists' Union. 1998. Check-list of North American Birds, 7th ed. Am. Ornithol. Union, Washington, D.C.

American Ornithologists' Union. 2000. Forty-second supplement to the American Ornithologists' Union *Check-list of North American Birds*. Auk 117:847–858.

Banks, R. C., Cicero, C., Dunn, J. L., Kratter, A. W., Rasmussen, P. E., Remsen, J. V., Jr., Rising, J. D. and Stotz, D. F. 2002. Forty-third supplement to the American Ornithologists' Union *Check-list of North American Birds*. Auk 119:897-906.

Bevier, L. R. 1990. Eleventh report of the California Bird Records Committee. W. Birds 21:145–176.

Binford, L. C. 1985. Seventh report of the California Bird Records Committee. W. Birds 16:29–48.

Birch, A., and Lee, C.T. 1997. Arctic and Pacific loons: Field idenfication. Birding 29:106–115.

Brown, R. G. B. 1980. The field identification of Black and Markham's storm-petrels *Oceanodroma melania* and *O. markhami*. Am. Birds 34:868.

Cole, L.W. 2000. A first Shy Albatross, *Thalassarche cauta,* in California and a critical re-examination of Northern Hemisphere records of the former *Diomedea cauta* complex. *N. Am. Birds* 54:124–135.

Figure 7. Immature Painted Bunting, *Passerina ciris*, in supplemental/transitory plumage at Galileo Hill Park, Kern County, 1 October 2000. Occurrences of this species in the West have increased, and a record nine individuals were accepted in California in 2000.

Photo by Larry Sansone

Collins, C.T. 1997. Hybridization of a Sandwich and Elegant Tern in California. W. Birds 28:169–173.

Cox, G. W. 1973. Hybridization between Mourning and MacGillivray's warblers. Auk 90:190–191.

Daniels, B. E., Hays, L., Hays, D., Morlan, J., and Roberson, D. 1989. First record of a Common Black-Hawk for California. W. Birds 20:11–18.

Dunn, J. L., and Garrett, K. L. 1997. A Field Guide to Warblers of North America. Houghton Mifflin, Boston.

Erickson, R. A., and Hamilton, R. A. 2001. Report of the California Bird Records Committee: 1998 records. W. Birds 32:13–49.

Erickson, R. A., and Terrill, S. B. 1996. Nineteenth report of the California Bird Records Committee: 1993 records. W. Birds 27:93–126.

Garrett, K. L., and Singer, D. S. 1998. Annual report of the California Bird Records Committee: 1995 records. W. Birds 29:133–156.

Goetz, R. E., Rudden, W. M., and Snetsinger, P. B. 1986. Slaty-backed Gull winters on the Mississippi. Am. Birds 40:207–216.

Gustafson, M. E., and Peterjohn, B. G. 1994. Adult Slaty-backed Gulls: Variability in mantle color and comments on identification. Birding 26:243–249.

Hainebach, K. 1992. First records of Xantus' Hummingbird in California. W. Birds 23:133–136.

Figure 8. Possible Slaty-backed Gull, *Larus schistisagus*, at Salton City, Imperial County, February 1998. The outermost primaries are still growing in, several months later than expected for the Slaty-backed and most other Northern Hemisphere gulls. This and other unusual features caused the bird's identification to be left unresolved.

Photos by Matthew T. Heindel

Figure 9. Pink-backed Pelican, *Pelecanus rufescens*, at Southeast Farallon I., San Francisco County, 23 October 2000. This bird's natural occurrence was considered questionable, but it is remarkable that even a presumed escaped bird made it to this remote locale.

Photo by Ivan Samuels

Hall, G. A. 1979. Hybridization between Mourning and MacGillivray's Warblers. Bird-Banding 50:101–107.

Harrison, P. 1983. Seabirds, An Identification Guide. Houghton Mifflin, Boston.

Harrison, P. 1987. Seabirds of the World, a Photographic Guide. Princeton Univ. Press, Princeton, NJ.

Heindel, M. T., and Garrett, K. L. 1995. Sixteenth annual report of the California Bird Records Committee. W. Birds 26:1–33.

Heindel, M. T., and Patten, M. A. 1996. Eighteenth report of the California Bird Records Committee: 1992 records. W. Birds 27:1–29.

Howell, S. N. G., and Corben, C. 2000a. Identification of Thayer's-like gulls: The Herring × Glaucous-winged Gull problem. Birders J. 9:25–33.

Howell, S. N. G., and Corben, C. 2000b. Retarded wing molt in Black-legged Kittiwakes. W. Birds 31:123–125.

Howell, S. N. G., and Webb, S. 1995. A Guide to the Birds of Mexico and Northern Central America. Oxford Univ. Press, Oxford, England.

Jaramillo, A. 2000. Punta Rusa, South America's first vagrant trap? Cotinga 14:33–38.

Johnsgard, P. A. 1993. Cormorants, Darters and Pelicans of the World. Smithsonian Inst. Press, Washington, D.C.

King, J. R., and Carey, G. J. 1999. Slaty-backed Gull hybridization and variation in adult upperparts colour. Birders J. 8:88–93.

Lethaby, N. 2000. The identification of Long-billed Murrelet in alternate plumage. Birding 32:438–444.

McCaskie, G., and San Miguel, M. 1999. Report of the California Bird Records Committee: 1996 records. W. Birds 30:57–85.

Mostello, C. S., Palaia, N. A., and Clapp, R. B. 2000. Gray-backed Tern (*Sterna lunata*), in The Birds of North America (A. Poole and F. Gill, eds.), no. 525. Birds N. Am., Philadelphia.

Murphy, R.C. 1936. Oceanic Birds of South America. Macmillian, New York.

Parkes, K. C. 1999. Head color in Bronzed Common Grackles, *Quiscalus quiscula versicolor*. W. Birds 30:174.

Patten, M. A., and Erickson, R. A. 1994. Fifteenth report of the California Bird Records Committee. W. Birds 25:1–34.

Patten, M. A., and Erickson, R. A. 2000. Population fluctuations of the Harris' Hawk

Figure 10. Female Darter, *Anhinga melanogaster*, at Ramer Lake, Imperial County, 13 July 2000. Presumed to be escaped from captivity, Darters have appeared at several locations in southern California and adjacent Baja California and may cause confusion with the Anhinga, *Anhinga anhinga*. Note the chestnut cap and nape, pale line leading back from the eye, and whitish throat merging into the rufous breast.

Photo by Kenneth Z. Kurland

(*Parabuteo unicinctus*) and its reappearance in California. J. Raptor Res. 34:187–195.

Patten, M. A., Finnegan, S. E., and Lehman, P. E. 1995. Seventeenth report of the California Bird Records Committee: 1991 records. W. Birds 26:113–143.

Patten, M. A., and Lasley, G. 2000. Range expansion of the Glossy Ibis in North America. N. Am. Birds 54:241–247.

Patten, M. A., and Marantz, C.A. 1996. Implications of vagrant southeastern vireos and warblers in California. Auk 113:911–923.

Pitman, R. L., and Jehl, J. R., Jr. 1998. Geographic variation and reassessment of species limits in the "Masked" boobies of the eastern Pacific Ocean. Wilson Bull. 110:155–170.

Pyle, P. 1993. A Markham's Storm-Petrel in the northeastern Pacific. W. Birds 24:108–110.

Pyle, P., and McCaskie, G. 1992. Thirteenth report of the California Bird Records Committee. W. Birds 23:97–132.

Reinking, D. L., and Howell, S. N. G. 1993. An Arctic Loon in California. W. Birds 24:189–196.

Roberson, D. 1986. Ninth report of the California Bird Records Committee. W. Birds

Figure 11. Adult Blue Mockingbird, *Melanotis caerulescens*, in Long Beach, Los Angeles County, 31 January 2000. The species was placed on the Supplement List because this individual was considered a possible escape from captivity. Note the aberrant tenth primary.

Photo by Kimball L. Garrett

17:49–77.

Roberson, D. 1993. Fourteenth report of the California Bird Records Committee. W. Birds 24:113–166.

Roberson, D. 1998. Sulids unmasked: Which large booby reaches California? Field Notes 52:276–297.

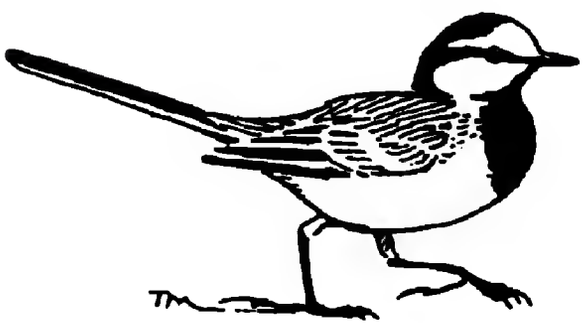
Rogers, M. M., and Jaramillo, A. 2002. Report of the California Bird Records Committee: 1999 records. W. Birds 33:1–33.

Rottenborn, S. C., and Morlan, J. 2000. Report of the California Bird Records Committee: 1997 records. W. Birds 31:1–37.

Tickell, W.L.N. 2000. Albatrosses. Yale Univ. Press, New Haven, CT.

Winter, J., and McCaskie, G. 1975. 1973 report of the California Field Ornithologists' Records Committee. W. Birds 6:135–144.

Accepted 16 July 2002



ABUNDANCE AND DISTRIBUTION OF THE COMMON RAVEN AND AMERICAN CROW IN THE SAN FRANCISCO BAY AREA, CALIFORNIA

JOHN P. KELLY and KATHERINE L. ETIENNE, Cypress Grove Research Center, Audubon Canyon Ranch, Marshall, California 94940

JENNIFER E. ROTH, Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach, California 94970

ABSTRACT: During the breeding season of 1999, we surveyed from roads in the San Francisco Bay area to determine the regional abundance and distribution of the Common Raven (*Corvus corax*) and American Crow (*C. brachyrhynchos*). Ravens concentrated along the outer coast and occurred in relatively low numbers in some interior areas, whereas the number of crows increased significantly from the outer coast to interior and bayshore locations. Both species occurred in significantly greater densities along urban and suburban survey routes than along rural routes, but dramatic exceptions were evident in some areas. Data from Breeding Bird Surveys, Christmas Bird Counts, and breeding bird atlases yielded similar distribution patterns. Breeding Bird Surveys and Christmas Bird Counts revealed strong regional increases in both species, but annual trends varied substantially at local scales. This variation, as well as significant abundance variation among survey routes, suggested considerable local differences in either habitat suitability or capacity for further population growth. Our results suggested that raven and crow populations may increase in both rural and developed areas undergoing rapid urbanization and that local conditions, rather than whether the habitat is rural or urban, may influence regional patterns.

Abundances of the Common Raven (*Corvus corax*) and American Crow (*C. brachyrhynchos*) have increased substantially over much of North America (Marzluff et al. 1994, Boarman and Heinrich 1999, Sauer et al. 2001). The Common Raven occurs throughout California but is scarce in much of the Central Valley, the central coast from the Santa Lucia Mountains south to northwestern Ventura County, and irrigated portions of the Coachella, Imperial and lower Colorado River valleys in the southeast corner of the state. The American Crow is widespread but absent from some drier western parts of the San Joaquin Valley, interior foothills, and the southeastern deserts (Small 1994). Throughout their range, ravens appear to be invading agricultural areas to a greater extent than urban areas (but are common in many urban areas), whereas crows appear to be invading urbanized areas more rapidly than agricultural areas (Marzluff et al. 1994, Marzluff and Restani 1999). Both species are resident through most of the San Francisco Bay area, a highly urbanized region with large sections that remain undeveloped or used for agriculture. Both species have increased in number recently in the southern portion of the region (Coston 1998). The overall status and distribution of these corvids within the San Francisco Bay area, however, have not been addressed.

To determine the abundance and distribution of ravens and crows in the San Francisco Bay area, we surveyed the region during the spring of 1999 (Figure 1). Because field observations were limited to repeated road surveys along particular routes within a single season, we compared the results with existing Breeding Bird Survey (BBS; Sauer et al. 2001), Audubon Christmas

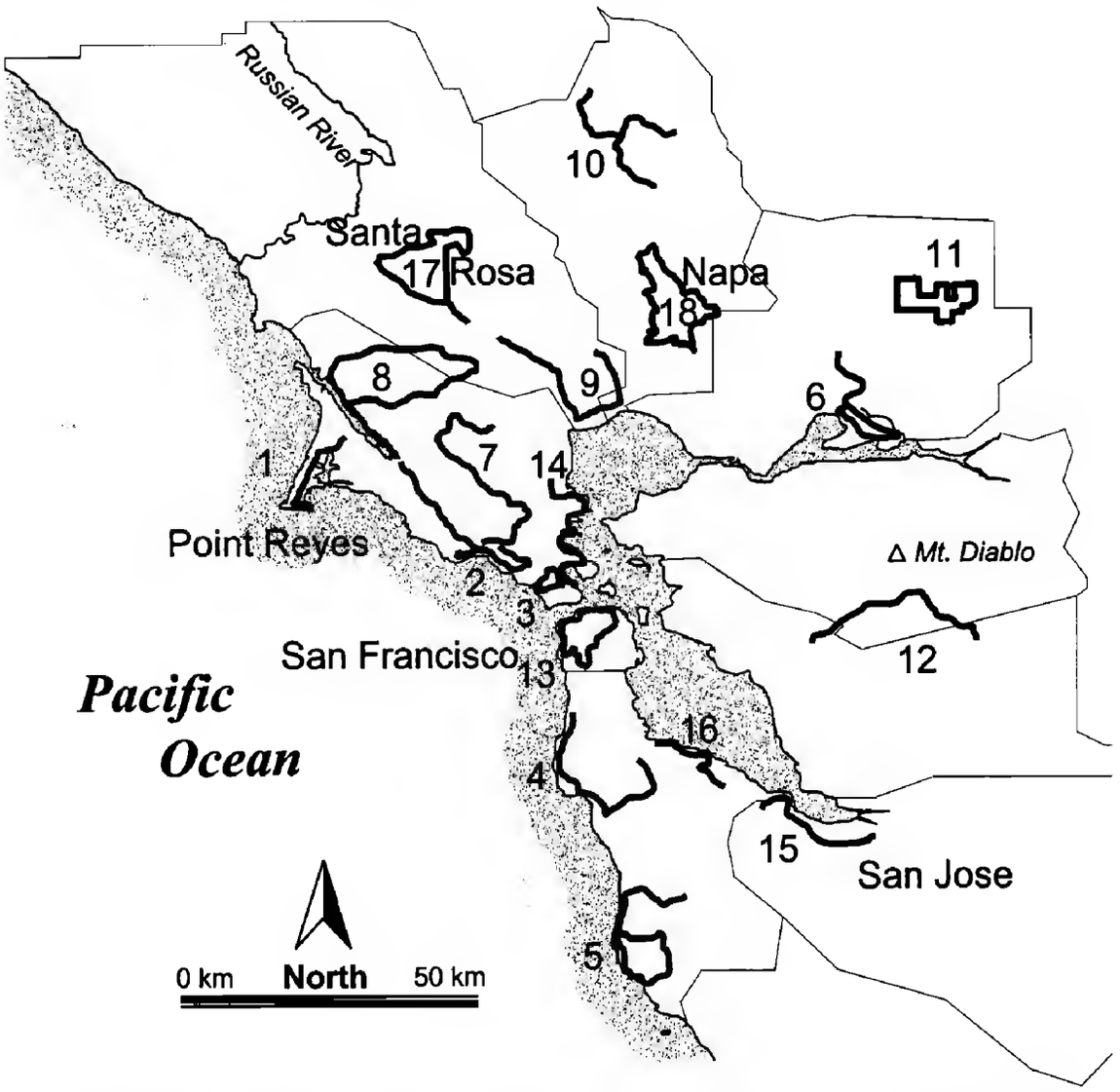


Figure 1. Routes used in road surveys of Common Ravens and American Crows in the San Francisco Bay area. Labels, route-identification numbers; thin lines, county boundaries (see Figures 5 and 6 for county names).

Bird Count (CBC; Butcher 1990), and breeding bird atlas (BBA; Robbins 1990) data to provide a more thorough perspective on regional distribution and to evaluate local and regional trends in abundance of these species.

STUDY AREA

The study area covered all nine counties adjacent to San Francisco Bay: Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, San Mateo, and San Francisco (Figure 1). The study area did not extend into the delta east of the confluence of the Sacramento and San Joaquin rivers. We did not conduct road surveys along the outer coast of Sonoma County or along the East Bay shoreline, although these areas are included in analyses of BBS, CBC, and BBA data. Analysis of BBS data included some routes that extended slightly beyond the bay area counties, into coastal Santa Cruz County to the south, coastal Mendocino County to the north, San Joaquin County to the east, and Yolo County to the north (Figure 2).

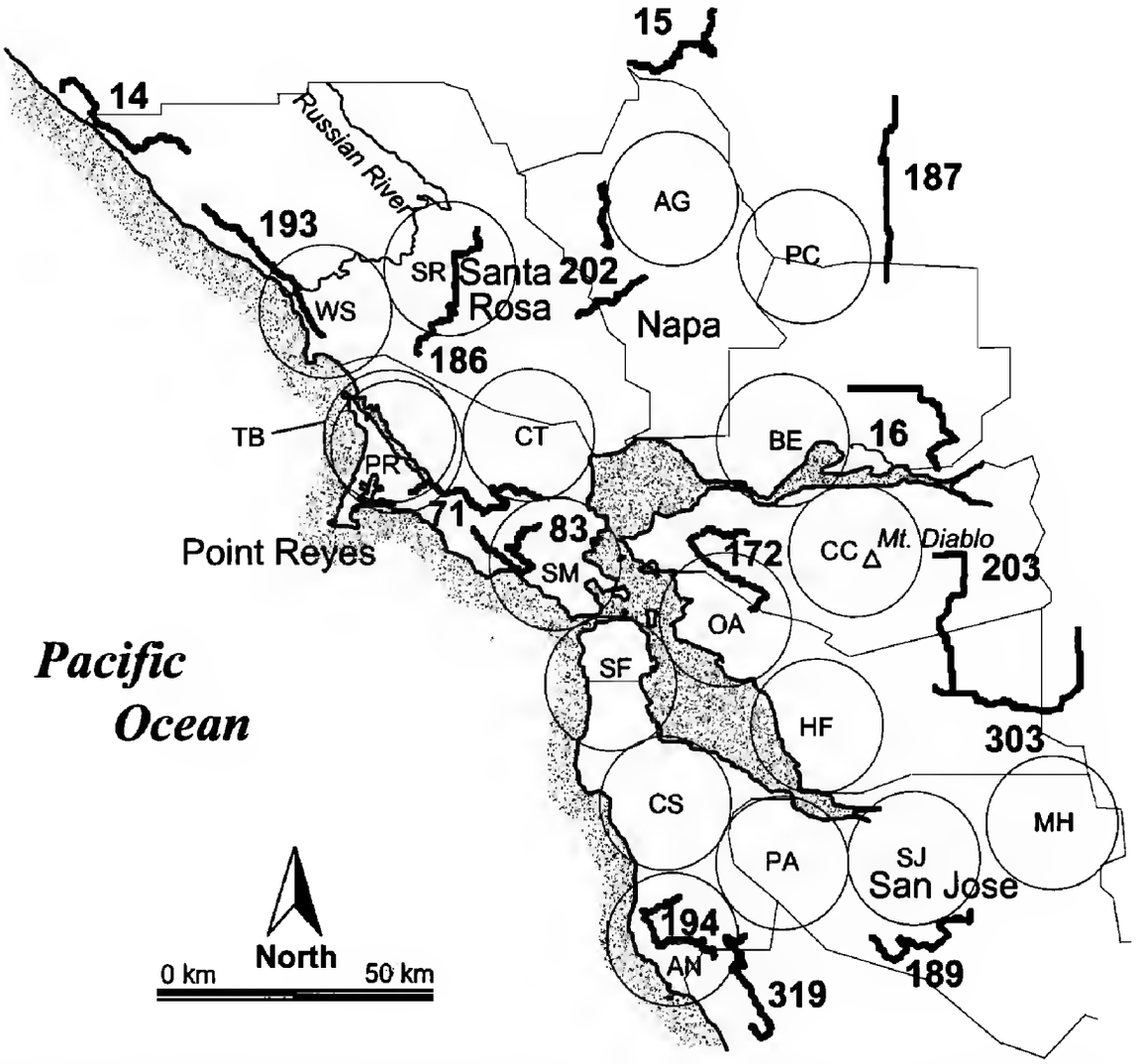


Figure 2. Breeding Bird Survey routes (bold lines and associated number codes) and Christmas Bird Count circles (letter codes) in the San Francisco Bay area. Thin lines, county boundaries (see Figures 5 and 6 for county names). See Tables 2, 3, and 4 for details on each route or circle.

Above the coastal terraces and alluvial shorelines, the area is characterized by rolling hills and mountains of the Coast Range. Moist coast redwood (*Sequoia sempervirens*), Douglas fir (*Pseudotsuga menziesii*), and mixed broad-leaved evergreen forests dominate the outer coastal drainages, giving way to wider expanses of grassland, chaparral, and oak woodland to the east. Nonnative eucalyptus (predominantly blue gum, *Eucalyptus globulus*) occurs throughout the region in patches mostly smaller than one hectare or as narrow windbreaks.

Urban and suburban habitats are concentrated in central Sonoma County near Santa Rosa, in southern Napa County near Napa, and south of Sonoma, Napa and Solano counties along bay shorelines. The shoreline and terraces along the outer coast and northern San Pablo and Suisun bays are generally rural and open. Rural areas are primarily used for agriculture, with range cattle production dominating most areas, dairy ranching locally dominant in the Point Reyes area, and farms and vineyards characterizing much of the northern portion of the region.

METHODS

From 26 March through 21 June 1999 we counted Common Ravens and American Crows along 18 survey routes averaging 49 ± 14.0 (standard deviation) km in length, established along roads throughout the region (Figure 1). We recruited 40 experienced birders, capable of distinguishing crows and ravens in the field, as volunteer observers to conduct mid-morning road surveys along each route twice monthly on standardized dates. Because each observer consistently surveyed the same route, rather than rotating among routes, observer variability could have influenced the results to an unknown extent. Survey teams consisting of one driver and one observer traveled at speeds of 56 to 72 km/h. Each survey began from a standard starting point. For each raven or crow observation, observers recorded the distance along the survey route, species name, group size (number of individuals within 100 m of each other), and perpendicular distance (<100 m, 100–200 m, or >200 m) from the road.

We distributed survey routes systematically to sample two land-use types (>75% rural vs. >75% urban/suburban) and three subregions (outer coast, bay shore, and inland). We apportioned the routes to approximate the extent of each land-use type and subregion within the study area and maximized the distances between routes to ensure independence of counts (Figure 1). To keep survey speed down, we avoided freeways and major highways. In urbanized areas, we selected routes that allowed observers to maintain normal survey speeds, although temporary slowing was necessary on some occasions. Given these constraints, suitable survey routes for each land-use type and subregion were sometimes determined by available roads. Open/rural habitat in the interior of the eastern portion of the study area and salt ponds in the southern part of the bay were undersampled relative to their extents.

We used the number of birds observed per kilometer of survey route to index corvid densities. We then examined differences between rural and urban/suburban habitats, and among coastal, interior, and bayshore locations using analysis of variance. Before analysis, we (natural) log-transformed the data so that densities did not differ significantly from normality ($P < 0.05$). Post hoc tests for differences among groups included Bonferroni adjustments for experimentwise error. Because routes were selected systematically on the basis of land use, subregion, and availability of roads, we modeled variation among routes nested within land use and location types as fixed effects. However, because routes covered a substantial portion of the study area and were selected to achieve a representative sample of regional populations, we also tested (wherever indicated in Results) the effects of land use and subregion against "random" variation among routes as a proxy for other, unknown influences on general regional patterns (Bennington and Thayne 1994). Indications of such influences should be interpreted cautiously because selection of survey routes was systematic rather than random.

We also examined BBS and CBC data, to determine regional trends in the numbers of ravens and crows and to compare abundances with patterns suggested by our road-survey data. The BBS is also a roadside survey, based on 50 three-minute point counts conducted along thousands of 39.4-km

routes over much of North America (Sauer et al. 2001). Because BBS surveys date back as far as 1966, they provide a perspective on changes in regional breeding-season abundance. We examined long-term trends in winter abundance with CBC data, which are based on total counts conducted annually within standard circles of 24.1-km diameter (458 km^2; Butcher 1990). We analyzed BBS and CBC trends by linear route regression, with regional trends expressed in percent change per year weighted by mean abundance and number of years covered at each BBS route or CBC location (Butcher et al. 1990, Geissler and Sauer 1990). We estimated the mean and variance of regional trends from 400 random bootstrap subsamples drawn with replacement from the original sample of trends (Geissler and Sauer 1990, Thomas and Martin 1996). CBC counts were standardized to reflect expected abundances and trends for the average effort (175 party-hours) in the study area over all count circles and years, using the procedure described by Butcher and McCulloch (1990; survey effort had no significant effect on raven numbers, $P > 0.90$). We modified calculation of the exponent relating survey effort to number of birds counted by including terms in the model (dummy variables) to account for unbalanced effects of CBC locations on the overall relation between effort and abundance. We did not adjust further for differences in effort, which include annual differences in distance covered per party-hour and distribution of effort among habitat types of varying suitability (e.g., ranch land vs. open water), although we considered habitat differences among count circles when interpreting the results. We emphasize that trends and abundances based on CBC data should be evaluated with considerable caution and confirmed by additional study because of these and other potential sources of error, including problems with identification, counting, weather, access, and habitat coverage (Butcher 1990).

We further evaluated regional breeding distributions by compiling breeding bird atlas (BBA) data within the study area. BBAs use standardized criteria to determine the breeding status (possible, probable, confirmed) of each bird species within 5-km^2 blocks (Robbins 1990) and are organized and developed separately by county (Marin County: Shuford 1993; Sonoma County: Burridge 1995; Napa County: R. Leong and B. Grummer, unpubl.; Contra Costa County: S. Glover, unpubl.; Alameda County: B. Richmond and H. Cogswell, unpubl.; Santa Clara County: Santa Clara Atlas Comm., unpubl.; San Mateo County: R. Johnson, unpubl.; San Francisco County: M. Eaton, unpubl.). Where atlas blocks spanned BBA (county) boundaries, we used the status code from the BBA that indicated the greatest likelihood of breeding for that location.

RESULTS

Differences in corvid numbers among survey routes, nested within land-use type or subregion, were greater than expected by the variability within routes ($F = 40.65$; df = 10, 110; $P < 0.0001$), indicating that variation among survey routes accounted for significant regional variability in corvid densities (Table 1, Figure 1). On average, 89% ± 2.3 (standard error) of ravens and 92% ± 1.8 of crows were observed within 200 m of survey

Table 1 Number of Common Ravens and American Crows Observed During Road Surveys in the San Francisco Bay Area During the Breeding Season of 1999

					Birds per kilometer			
					Common Raven		American Crow	
Route	Land Use	Subregion	Length (km)	*N*	Mean	(SE)[a]	Mean	(SE)
1	Rural	Coast	19.4	12	0.584	(0.290)	0.014	(0.010)
2	Rural	Coast	59.4	18	0.040	(0.005)	0.222	(0.030)
3	Rural	Coast	33.0	7	0.241	(0.081)	0.322	(0.078)
4	Rural	Coast	41.6	7	0.169	(0.024)	0.034	(0.014)
5	Rural	Coast	50.8	7	0.128	(0.018)	0.000	(0.000)
6	Rural	Bay	41.0	7	0.038	(0.019)	0.056	(0.025)
7	Rural	Interior	50.7	2	0.089	(0.010)	0.335	(0.177)
8	Rural	Interior	79.8	6	0.029	(0.013)	0.090	(0.023)
9	Rural	Interior	65.2	6	0.070	(0.036)	0.116	(0.039)
10	Rural	Interior	40.9	4	0.006	(0.006)	0.000	(0.000)
11	Rural	Interior	51.0	8	0.007	(0.005)	2.457	(0.567)
12	Rural	Interior	41.8	3	0.016	(0.016)	0.318	(0.076)
13	Urban/Suburban	Coast	39.6	7	0.375	(0.086)	0.007	(0.005)
14	Urban/Suburban	Bay	46.2	7	0.012	(0.009)	0.444	(0.079)
15	Urban/Suburban	Bay	50.4	6	0.205	(0.016)	0.251	(0.054)
16	Urban/Suburban	Bay	41.8	6	0.134	(0.040)	0.017	(0.017)
17	Urban/Suburban	Interior	63.1	7	0.238	(0.036)	0.253	(0.044)
18	Urban/Suburban	Interior	65.4	5	0.003	(0.003)	0.281	(0.075)

[a]SE, standard error.

routes, with 69% ± 4.4 of ravens and 70% ± 7.1 of crows observed within 100 m. The proportion of crows or ravens that occurred in pairs, suggesting possible breeding status, did not differ significantly by land use, subregion, or route ($P > 0.05$).

American Crow

In general, densities of American Crows along rural and urban/suburban survey routes did not differ significantly ($F = 1.76$; df = 1,110; $P = 0.19$). If route 11, an open agricultural area with unusually high numbers of crows (Table 1) was excluded, however, crows were significantly more abundant along urban/suburban survey routes than along the remaining rural routes ($F = 10.9$; df= 1, 103; $P < 0.01$; Figure 3). When tested against random route effects (see Methods), the number of crows in rural and urban/suburban areas did not differ significantly ($F = 0.39$; df = 1, 15; $P = 0.54$).

Densities of crows along survey routes did vary significantly by subregion ($F = 50.5$; df = 2, 110; $P < 0.0001$), with numbers increasing significantly from the outer coast to the bay shore to the interior ($P < 0.01$). If route 11, an interior route with unusually high numbers of crows (Table 1) was excluded, densities in bayshore and interior locations did not differ ($P >$

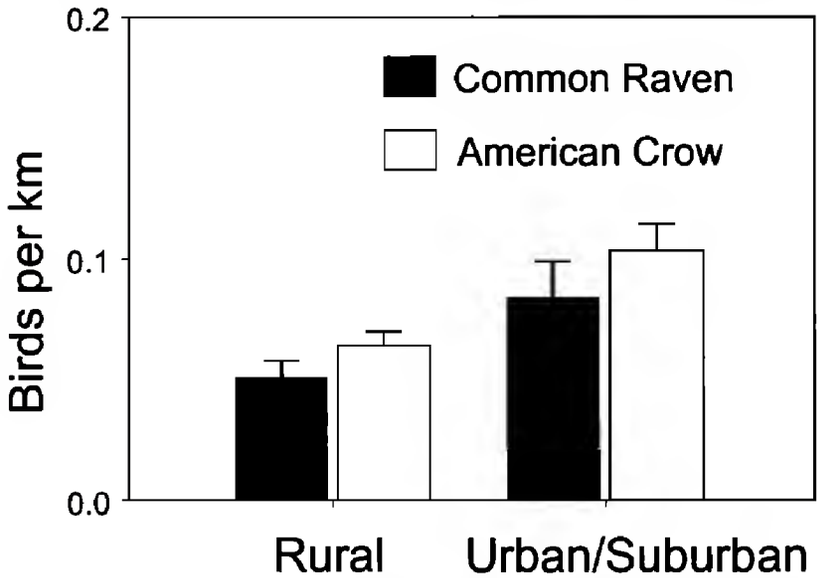


Figure 3. Mean number of Common Ravens and American Crows observed per kilometer of survey route by rural or urban/suburban land use in the San Francisco Bay area. Values for the American Crow exclude route 11 (see text). Error bars, standard errors.

0.99; Figure 4). Despite significantly lower densities of crows along outer-coast routes, differences by location were not significantly greater than the estimated random variation across the region (random effects $F = 1.54$; df=2, 15; $P = 0.25$). Land use and subregion influenced the number of crows on each route independently ($F = 0.13$; df = 2, 112; $P > 0.87$).

Common Raven

Densities of Common Ravens were significantly greater along survey routes in urban/suburban than in rural areas ($F = 5.75$; df = 1, 107; $P = 0.02$; Figure 3). In contrast, the highest numbers of ravens occurred in the pastoral zone of Point Reyes National Seashore (route 1; Table 1, Figure 1). Land-use effects did not differ significantly from estimated random variation in the region (random route effects $F = 0.70$; df = 1, 16; $P = 0.41$).

Raven densities varied significantly by subregion ($F = 18.66$; df = 2, 107; $P < 0.0001$), with numbers increasing significantly from interior to bayshore to outer-coast survey locations ($P < 0.05$; Figure 4). The test for random route effects revealed a significant contrast between the outer-coast routes and the bay shore or interior ($F = 5.12$; df = 1, 15; $P = 0.04$). Therefore, higher concentrations of ravens characterize the outer coast. Land use and subregion influenced the number of ravens on each route independently ($F = 0.003$; df = 2, 108; $P > 0.95$).

Other Survey Data

Numbers of ravens and crows observed along 15 BBS routes in the San Francisco Bay area reveal distribution patterns similar to those suggested by our road survey, including dramatic abundance variation from route to route (Table 2). BBS data suggest significant overall annual increases in both ravens (5.16% ± 0.15; $P < 0.001$) and crows (3.21% ± 0.13; $P < 0.001$).

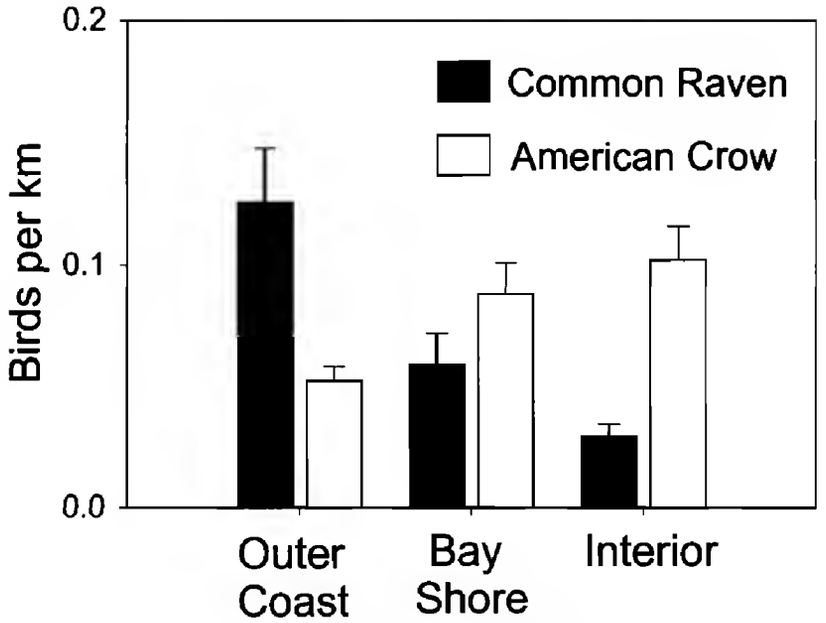


Figure 4. Mean number of Common Ravens and American Crows observed per kilometer of survey route in outer coast, San Francisco Bay shore, and interior subregions in the San Francisco Bay area. Values for the American Crow exclude route 11 (see text). Error bars, standard errors.

BBS trends vary greatly across the region, however, suggesting effects at smaller scales (Table 2). BBS data imply strong increases in the number of ravens along the southern outer coast of the study area and in central Napa County. They suggest significant increases in crows near Santa Rosa and along part of the outer Sonoma coast. Crows apparently increased along route 203 in the eastern interior of Contra Costa and Alameda counties from 1972 to 1991 but declined along nearby BBS route 303 from 1992 to 1999 (Table 2, Figure 2). Inspection of scatterplots for all individual routes, however, suggested that such differences may depend on the number of years surveyed, because linear slopes measured over periods of less than 8–10 years may contrast with longer-term trends.

CBC data reveal significant overall annual increases since 1950 in numbers of both ravens (6.57% ± 0.12; $P < 0.001$) and crows (3.31% ± 0.05; $P < 0.001$), increases that accelerated during the 1980s and 1990s (ravens: 7.23% ± 0.16, $P < 0.001$; crows: 5.02% ± 0.08, $P < 0.001$). Patterns of variation in abundance by CBC circle are generally consistent with road-survey and BBS results and suggest substantial local variation in numbers of both ravens and crows (Tables 3 and 4).

In neither BBS or CBC results did we find significant correlations, positive or negative, between the two species' abundances or trends ($P < 0.05$), suggesting their distributions are independent. In contrast, our road surveys imply a significant inverse relationship between raven and crow abundances ($r = -0.55$, $P < 0.05$), suggesting their distributions are complementary. For example, raven and crow numbers varied dramatically among urbanized routes, with high numbers of ravens in San Francisco but relatively few crows, and surprisingly low numbers of ravens along the urbanized corridor

Table 2 Breeding Bird Survey Trends and Mean Number of Birds per Survey Route for the Common Raven and American Crow in the San Francisco Bay Area

			American Crow		Common Raven	
BBS route[a]	Period	Years surveyed	Trend (% per year)[b]	Mean birds per route	Trend (% per year)[b]	Mean birds per route
14	1968–2000	31	−3.27	0.55	2.33**	20.48
15	1969–2000	27	−11.12	2.52	10.00	1.81
16	1968–2000	18	6.80	6.39	19.92	1.17
71	1971–2000	24	1.82	20.75	6.45	7.83
83	1975–2000	25	1.34	17.18	0.36	7.65
172	1972–2000	19	−10.92	4.05	0.00	0.05
186	1972–2000	28	9.07**	52.50	0.32	1.86
187	1972–1988	14	12.30**	24.78	0.00	0.21
189	1972–2000	20	3.04	25.30	9.42	0.45
193	1972–2000	25	19.89*	1.12	−5.40**	8.88
194	1972–1995	23	−1.40	0.07	18.10*	0.52
202	1972–1997	26	0.12	29.54	10.93**	4.81
203	1972–1991	20	13.07**	13.30	−6.83	0.15
303	1992–1999	7	−8.13**	124.43	6.75	6.43
319	1992–1996	5	0.00	0.00	37.02*	18.20

[a]See Figure 2 for location.

[b]Linear trend significant at $^{*}P < 0.05$, $^{**}P < 0.01$.

of eastern Marin County where crows were relatively abundant (routes 13 and 14, Table 1).

Composite breeding bird atlases for the region reflect distributions that are generally consistent with the road surveys and BBS (Figures 5 and 6). We emphasize that atlas data for the bay area represent a wide range of sampling periods dating back as far as the late 1970s and should therefore be interpreted with considerable caution and careful comparisons with other available data. BBAs indicate Common Raven concentrations along the outer coast, particularly in the Point Reyes area and along the San Francisco and San Mateo coast, in urbanized areas along the southern San Francisco Bay shoreline, in some higher elevations of eastern Contra Costa, Alameda, and Santa Clara counties, and in parts of Napa county. Such "concentrations" are based on a greater frequency of 5-km^2 blocks with breeding ravens, rather than greater raven abundances per se. However, broad areas with breeding confirmed over many adjacent blocks are likely to support more ravens than areas where breeding is confirmed in only a few blocks. Breeding ravens appear to be relatively scarce in large areas of central Contra Costa, Alameda, and Santa Clara counties and in relatively low numbers in central Sonoma County. BBAs reveal that the American Crow's breeding distribution is relatively continuous in most bayshore and interior areas (although habitat is not necessarily saturated) but sparse or broken in many parts of the outer coastal drainage (Figure 6). In addition to resembling

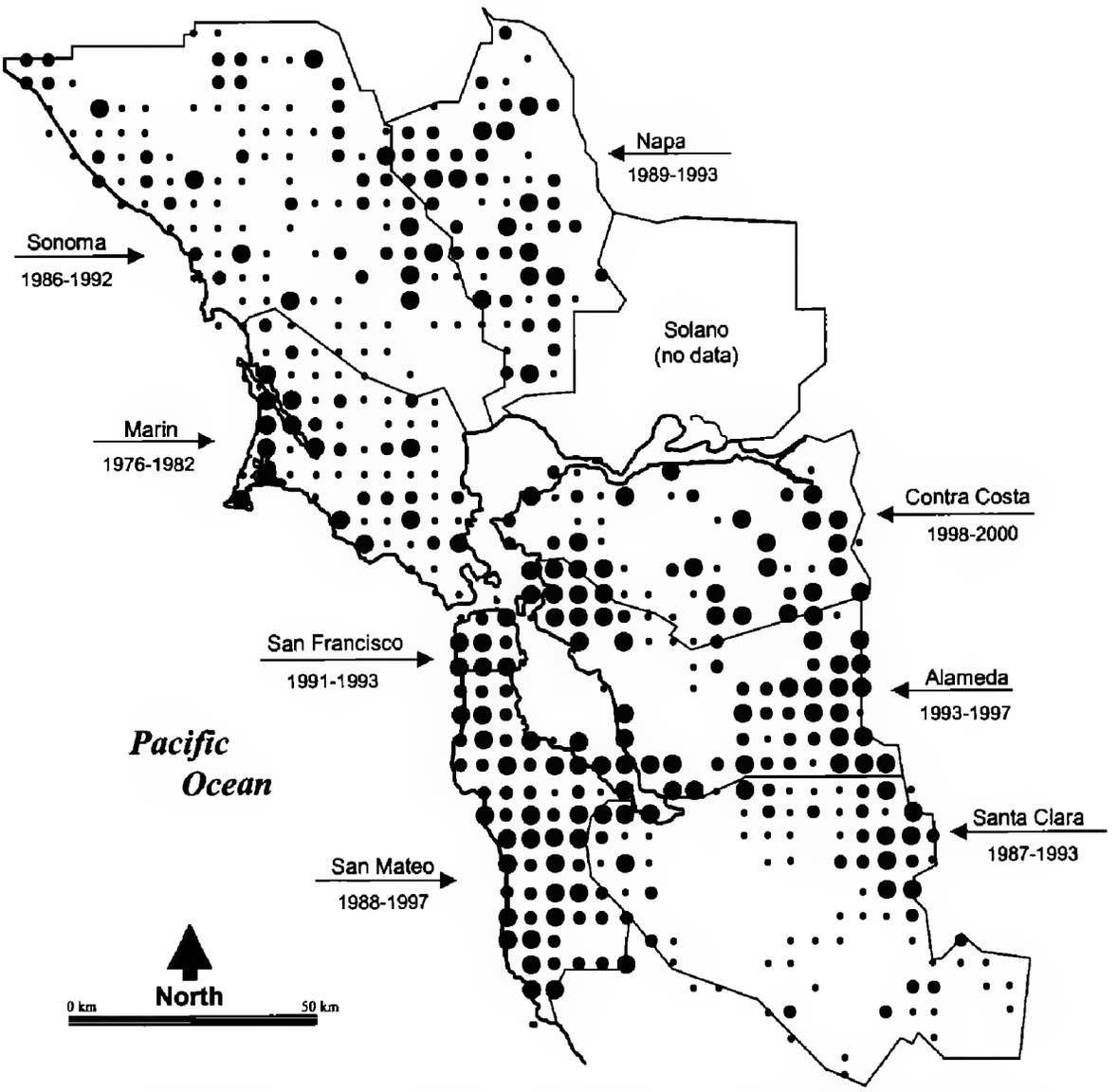


Figure 5. Breeding distribution of the Common Raven in the San Francisco Bay area, based on breeding bird atlas data. Filled circles indicate likelihood of breeding in each 5-km block: large circle, confirmed; medium circle, probable; small circle, possible; no circle, no ravens observed. Field data were collected in the years indicated under each county name.

patterns emerging from the road survey and BBS (Tables 1 and 2), BBA patterns are generally consistent with winter distributions indicated by CBC results. CBCs, however, suggest lower concentrations of ravens along the east side of southern San Francisco Bay and higher concentrations of crows in western Sonoma County (Tables 3 and 4).

DISCUSSION

Increases in the numbers of ravens and crows in the San Francisco Bay area are consistent with increases throughout the western United States, but in the bay area raven distribution differs from patterns evident at larger scales with regard to urbanization (Marzluff et al. 1994). BBS data imply that Common Raven densities in the western United States are negatively

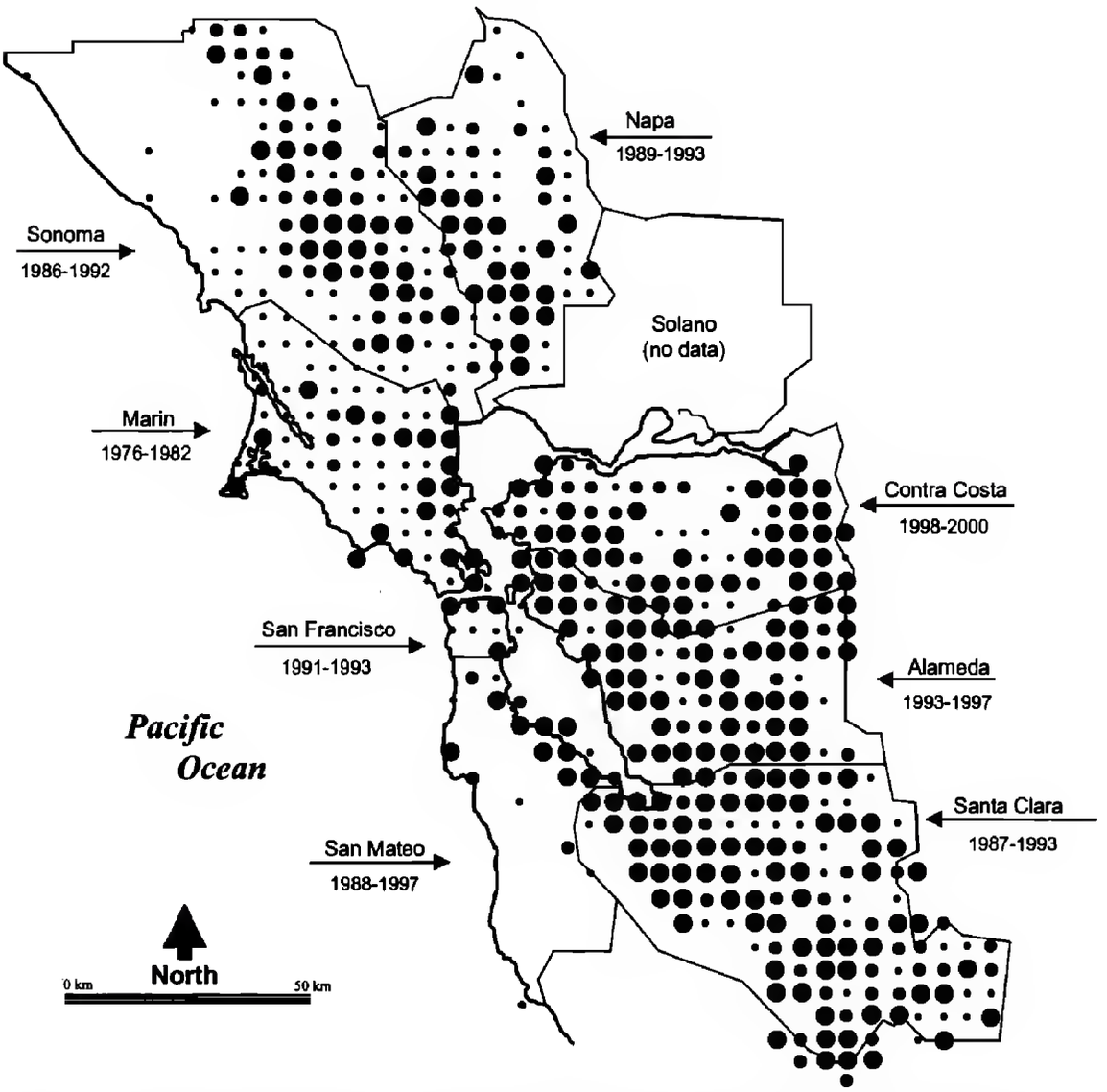


Figure 6. Breeding distribution of the American Crow in the San Francisco Bay area, based on breeding bird atlas data. Filled circles indicate likelihood of breeding in each 5-km block: large circle, confirmed; medium circle, probable; small circle, possible; no circle, no ravens observed. Field data were collected in the years indicated under each county name.

associated with human densities (although less strongly in coastal states), with ravens apparently invading agricultural areas to a greater extent than urban areas (Marzluff et al. 1994). In contrast, we found greater raven densities along urbanized survey routes, on average, than along rural survey routes, a pattern similar to that in the Mojave Desert (Knight et al. 1993). However, both our highest and lowest raven densities were along rural routes, the highest in the agricultural zone of Point Reyes National Seashore (dominated by dairy ranches), and the lowest in the rural interior of Alameda and Napa counties.

Common Ravens occurred in significantly greater densities along the outer coast than in the interior of the region or near the bay (although the east bay shoreline was not included in our road survey). In such coastal habitats, ravens feed on livestock carcasses, grain in cattle feedlots, and a

Table 3 Christmas Bird Count Trends and Mean Number of Birds per Count Circle for the American Crow in the San Francisco Bay Area

	1950–1998			1980–1998		
Count Circle[a]	Years	Trend (% per year)[b]	Mean birds per circle	Years	Trend (% per year)[b]	Mean birds per circle
Angwin (AG)	39	3.66***	516.10	18	–0.69	681.75
Año Nuevo (AN)	26	3.01	2.50	18	–3.34	3.36
Arroyo Cheap Thrills (CT)	10	2.96	1543.27	8	1.65	1604.26
Benicia (BE)	37	17.77***	50.86	19	15.24***	96.46
Contra Costa (CC)	43	9.06***	46.90	19	8.73**	69.46
Crystal Springs Reservoir (CS)	41	6.33***	16.36	18	23.92***	32.99
Hayward–Fremont (HF)	29	1.45	72.99	17	10.90***	62.85
Mount Hamilton (MH)	21	1.24	101.75	19	4.25	97.27
Oakland (OA)	45	4.01***	43.96	18	5.31*	56.73
Palo Alto (PA)	39	14.81***	22.86	19	13.24***	43.39
Point Reyes (PR)	27	1.56*	605.44	19	–0.15	653.41
Putah Creek (PC)	26	10.52***	316.29	19	16.28***	382.64
San Francisco (SF)	29	10.51***	36.97	15	23.48***	70.28
San Jose (SJ)	47	0.18	180.47	19	9.61***	148.48
Santa Rosa (SR)	36	0.49	1547.83	19	4.70***	1581.53
Southern Marin County (SM)	23	7.56***	494.32	19	6.39***	556.13
Tomales Bay (TB)	13	2.63	365.71	0		
Western Sonoma County (WS)	31	4.03***	241.11	19	2.19	284.10

[a]See Figure 2 for location.

[b]Linear trend significant at $^{*}P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$.

variety of other foods found in grasslands, at public picnic areas, and along dunes and beaches (Roth et al. 1999). Ravens also exploit garbage dumps (Marzluff et al. 1998), which are often located in rural areas. However, our road survey indicated that high raven numbers in coastal agricultural areas are matched by similarly high numbers in the most urbanized habitats around San Francisco Bay.

Although our road survey did not include urban areas in the east bay, BBA data show that breeding ravens and crows are established there, and CBC data suggest significant increases in both species. Over the past 20 years, ravens have established themselves and increased their numbers near salt ponds along the southern east bay shoreline (H. Cogswell pers. comm.).

The number of American Crows in California increased dramatically with the spread of agriculture in the early 1900s (Emlen 1940). BBS data, however, show that crow abundances in the western United States are negatively associated with the extent of farmland and positively correlated with human population density (Marzluff et al. 1994). Consistent with this pattern, our results revealed that crows concentrate in urbanized habitats

Table 4 Christmas Bird Count Trends and Mean Number of Birds per Count Circle for the Common Raven in the San Francisco Bay Area

	1950–1998			1980–1998		
Count Circle[a]	Years	Trend (% per year)[b]	Mean birds per circle	Years	Trend (% per year)[b]	Mean birds per circle
Angwin (AG)	40	9.18***	23.53	19	5.53*	35.84
Año Nuevo (AN)	26	19.39***	30.62	18	14.57***	43.50
Arroyo Cheap Thrills (CT)	10	−1.00	60.40	8	0.84	57.75
Benicia (BE)	37	8.02***	4.65	19	9.72**	8.32
Contra Costa (CC)	43	5.70***	2.14	19	7.47**	4.21
Crystal Springs Reservoir (CS)	42	12.86***	27.95	18	25.16***	62.22
Hayward–Fremont (HF)	30	3.93*	2.07	18	12.87**	2.89
Mount Hamilton (MH)	21	9.13***	24.57	19	9.21***	26.32
Oakland (OA)	46	8.99***	8.59	18	17.86***	21.17
Palo Alto (PA)	39	15.66***	23.95	19	12.09***	47.95
Point Reyes (PR)	28	0.87	347.57	19	0.58	365.32
Putah Creek (PC)	27	11.76***	9.89	19	18.13***	13.37
San Francisco (SF)	29	7.21***	40.69	15	18.32***	73.07
San Jose (SJ)	47	5.69***	7.09	19	25.07***	14.11
Santa Rosa (SR)	35	5.18***	22.06	19	6.73***	28.00
Southern Marin County (SM)	23	8.29***	125.87	19	8.98***	140.63
Tomales Bay (TB)	13	22.39***	170.31	0		
Western Sonoma County (WS)	28	2.17**	208.75	16	−0.75	230.38

[a]See Figure 2 for location.

[b]Linear trend significant at $^{*}P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$.

over most of the San Francisco Bay area and occur in relatively low numbers in many rural areas. Yet there is a dramatic exception to this pattern in farmland northeast of Suisun Bay (Route 11), where we found the highest regional densities of crows; the reasons for these high densities are unknown.

Breeding ravens and crows generally move less than 3–7 km per day (Engel and Young 1992, Linz et al. 1992, Sullivan and Dinsmore 1992, Caccamise et al. 1997, Roth et al. 1999). Therefore, the 50-km routes used in our road survey were probably of a length suitable to capture differences in local abundance near the appropriate scale of landscape use. Although we did not measure detection probabilities associated with distance from the road, ravens and crows are relatively conspicuous birds; their dramatically higher densities within 100 m of survey roads suggest habits of foraging on highway-generated carrion (Knight and Kawashima 1993).

The effects of landscape properties on population growth cannot be determined from our count data because differences in bird density might not be related to productivity or survivorship. Studies based on individually marked birds are needed to determine if behavioral adjustments to urbanization or

anthropogenic food sources lead to changes in crow or raven population growth or distribution (Knight et al. 1987, Marzluff et al. 1998). Of particular concern is whether increases in numbers of ravens and crows might signal increases in nest predation of other native species, including waterfowl (Stiehl and Trautwein 1991), the Marbled Murrelet (*Brachyramphus marmoratus*; Singer et al. 1991, Nelson and Hammer 1995), Snowy Plover (*Charadrius alexandrinus*; U. S. Fish and Wildlife Service 1993), Least Tern (*Sterna antillarum*; Fancher 1992, Avery 1995), Common Murre (*Uria aalge*; Thayer et al. 1999, Roth et al. 1999), herons and egrets (Ardeidae; Parsons 1995, Kelly and Fischer 2000), and forest-nesting passerines (Andren 1992, Buler and Hamilton 2000). However, corvid numbers may correlate poorly with overall nest-predation rates, especially if changes in corvid abundance influence rates of nest predation by other species (Clark et al. 1995). Additional studies are needed to test for the independent effects of increasing corvid densities on the population dynamics of other species.

With the exception of a greater concentration of ravens along the outer coast, variation in abundance of crows and ravens among coastal, bayshore, and interior subregions did not seem to exceed random differences in the region. Similarly, variation in corvid numbers and trends suggests substantial variation with local conditions. Also, the inverse relationship between abundances of ravens and crows did not correspond to differences in rural vs. urbanized habitat and was not significant in other available data. Thus, factors affecting differences in species distribution and habitat use may be complex, with local-scale habitat variation influencing the general regional pattern. Further study is needed to determine the extent to which local conditions reflect differences in habitat suitability for foraging or breeding, or alternatively, differences in habitat saturation and associated capacity for further population growth.

ACKNOWLEDGMENTS

We thank the following observers for conducting road surveys: Sarah Allen, Margaret Barson, Charles Benedict, Noelle Bon, Susan Buckner, Lynn Campbell, Ted and Zoe Chandik, Rigdon Currie, Nancy DeStefanis, Katie Etienne, Binny Fischer, Leslie Flint, Graeme Fraser, Harry and Kate Fuller, Tom Gardali, Keith and Kaire Gish, Pat and Phil Gordon, Jim Hench, Conrad Jones, Gail Kabat, Barbara Lapp, Flora Maclise, Jo Maillard, Dan and Joan Murphy, Robert Northrop, Linda Reichel, Rudi Richardson, Jared Roth, Ellen Sabine, Don and Marilyn Sanders, Danielle Saunders, Robin Smith, Sue Spoffard, and Paula Terry. We thank Katie Fehring, Elizabeth Lynn, Mark McCaustland, and Sue Guers for organizing and compiling the data. Lynn Campbell and Graeme Fraser assisted in the development of the field protocol. Doug Oman provided advice on the statistical analysis. Howard L. Cogswell, Mark K. Sogge, and an anonymous reviewer provided helpful comments on the manuscript. This project received financial support from the Marin Community Foundation and the Marin and Sequoia chapters of the National Audubon Society.

LITERATURE CITED

Andren, H. 1992. Corvid density and nest predation in relation to forest fragmentation: A landscape perspective. Ecology 73:794–804.

Avery, M. L., Pavelka, M. A., Bergman, D. L., Decker, D. G., Knittle, C. E., and Linz, G. M.. 1995. Aversive conditioning to reduce raven predation on California Least Tern eggs. Colonial Waterbirds 18:131–138.

Bennington, C. C., and Thayne, W. V. 1994. Use and misuse of mixed model analysis of variance in ecological studies. Ecology 75:717–722.

Boarman, W. I., and Heinrich, B. 1999. Common Raven (*Corvus corax*), in The Birds of North America (A. Poole and F. Gill eds.), no. 476. Birds N. Am., Philadelphia.

Buler, J. J., and Hamilton, R. B. 2000. Predation of natural and artificial nests in a southern pine forest. Auk 117:739–747.

Burridge, B. 1995. Sonoma County Breeding Bird Atlas. Madrone Audubon Soc., P. O. Box 1911, Santa Rosa, CA 95402.

Butcher, G. S. 1990. Audubon Christmas Bird Counts, in Survey Designs and Statistical Methods for the Estimation of Avian Population Trends (J. R. Sauer and S. Droege, eds.), pp. 5–13. U. S. Fish and Wildlife Serv. Biol. Rep. 90.

Butcher, G. S., and McCulloch C. E. 1990. Influence of observer effort on the number of individual birds recorded on Christmas Bird Counts, in Survey Designs and Statistical Methods for the Estimation of Avian Population Trends (J. R. Sauer and S. Droege, eds.), pp. 120–129. U. S. Fish and Wildlife Serv. Biol. Rep. 90.

Butcher, G. S., Fuller, M. R., McAllister, L. S., and Geissler, P. H. 1990. An evaluation of the Christmas Bird Count for monitoring of population trends of selected species. Wildlife Soc. Bull. 18:129–134.

Caccamise, D. F., Reed, L. M., Romanowski, J., and Stouffer, P. C. 1997. Roosting behavior and group territoriality in American Crows. Auk 114:628–637.

Clark, R. G., Meger, D. E., and Ignatiuk, J. B. 1995. Removing American Crows and duck nesting success. Can. J. Zool. 73:518–522.

Coston, C. 1998. Changing Bay Area bird populations: The corvids. The Stilt, newsletter of the San Francisco Bay Bird Observatory 17:4–5.

Emlen, J. T. 1940. The midwinter distribution of the crow in California. Condor 42:287–294.

Engel, P. R., and Young, L. S. 1992. Movements and habitat use by Common Ravens from roost sites in southwestern Idaho. J. Wildlife Mgmt. 56:596–602.

Fancher, J. M. 1992. Population status and trends of the California Least Tern. Trans. W. Sect. Wildlife Soc. 28:59–66.

Geissler, P. H., and Sauer, J. R. 1990. Topics in route-regression analysis, in Survey Designs and Statistical Methods for the Estimation of Avian Population Trends (J. R. Sauer and S. Droege, eds.), pp. 54–57. U. S. Fish and Wildlife Serv. Biol. Rep. 90.

Kelly, J. P., and Fischer, B. 2000. 1999 heron and egret monitoring results at West Marin Island. ACR Tech. Rep. 90-3-10 (order from Audubon Canyon Ranch, 4900 Shoreline Hwy., Stinson Beach, CA 94970).

Knight, R. L., Grout, D. J., and Temple, S. A. 1987. Nest-defense behavior of the American Crow in urban and rural areas. Condor 89:175–177.

Knight, R. L., and Kawashima, J. Y. 1993. Responses of raven and Red-tailed Hawk populations to linear right-of-ways. J. Wildlife Mgmt. 57:266–271.

Knight, R. L., Knight, H. A. L., and Camp, R. J. 1993. Raven populations and land-use patterns in the Mojave Desert, California. Wildlife Soc. Bull. 21:469–471.

Linz, G. M., Knittle, C. E., and Johnson, R. E. 1992. Home range of breeding Common Ravens in coastal southern California. Southw. Nat. 37:199–202.

Marzluff, J. M., Boon, R. B., and Cox, G. W. 1994. Historical changes in populations and perceptions of native pest and bird species in the West. Studies Avian Biol. 15:202–220.

Marzluff, J. M., Gehlbach, F. R., and Manuwal, D. A. 1998. Urban environments: Influences on avifauna and challenges for the avian conservationist, In Avian Conservation: Research and Management (J. M. Marzluff and R. Sallabanks, eds.), pp. 283–299. Island Press, Washington, D.C.

Marzluff, J. M., and Restani, M. 1999. The effects of forest fragmentation on avian nest predation, in Forest Fragmentation: Wildlife and Management Implications (J. A. Rochelle, L. A. Lehmann, and J. Wisniewski, eds.), pp. 155–169. Brill, Leiden, Netherlands.

Nelson, S. K., and Hamer, T. 1995. Nest success and the effects of predation on Marbled Murrelets, in The ecology and conservation of the Marbled Murrelet in North America: An interagency scientific evaluation (C. J. Ralph, G. L. Hunt, M. G. Rafael, and J. F. Piatt, eds.), pp. 89–97. U. S. Dept. Agric. Forest Serv. Gen. Tech. Rep. PSW-GTR-152.

Parsons, K. C. 1995. Heron nesting at Pea Patch Island, Upper Delaware Bay, USA: Abundance and reproductive success. Colonial Waterbirds 18:69–78.

Robbins. C. S. 1990. Use of breeding bird atlases to monitor population change, in Survey Designs and Statistical Methods for the Estimation of Avian Population Trends (J. R. Sauer and S. Droege, eds.), pp. 18–22. U. S. Fish and Wildlife Serv. Biol. Rep. 90.

Roth, J. E., Kelly, J. P., Sydeman, W. J., Parker, M. W., and Allen, S. G. 1999. Ecosystem-level management of Common Ravens on the Point Reyes National Seashore. Report to Point Reyes National Seashore, Point Reyes Station, CA 94956.

Sauer, J. R., Hines, J. E., and Fallon, J. 2001. The North American Breeding Bird Survey, Results and Analysis 1966–2000. Version 2001.2. U.S. Geol. Surv. Patuxent Wildlife Res. Center, Laurel, MD.

Shuford, D. W. 1993. The Marin County Breeding Bird Atlas. Bushtit Books, Bolinas, CA.

Singer, W. W., Naslund, N. L., Singer, S. A., and Ralph, C. J. 1991. Discovery and observations of two tree nests of the Marbled Murrelet. Condor 93:330–339.

Small, A. 1994. California Birds: Their Status and Distribution. Ibis Publ., Vista, CA.

Stiehl, R. B., and Trautwein, S. N. 1991. Variations in diets of nesting Common Ravens. Wilson Bull. 103:83–92.

Sullivan, B. D., and Dinsmore, J. J. 1992. Home range and foraging habitat of American crows, *Corvus brachyrhynchos,* in a waterfowl breeding area in Manitoba. Can. Field-Nat. 106:181–184.

Thayer, J. A., Sydeman, J., Fairman, N. P., and Allen, S. G. 1999. Attendance and effects of disturbance on coastal Common Murre colonies at Point Reyes, California. Waterbirds 22:130–139.

Thomas, L., and Martin, K. 1996. The importance of analysis method for breeding bird survey population trend estimates. Cons. Biol. 10:479–490.

U. S. Fish and Wildlife Service. 1993. Final rule: Western Snowy Plover. Fed. Reg. 58:12865–12874.

Accepted 12 July 2002

FEATURED PHOTO

IDENTIFICATION PROBLEMS WITH LARGE GULLS

STEVE N. G. HOWELL, PRBO, 4990 Shoreline Highway, Stinson Beach, California 94970

The identification of large gulls is among the most difficult and contentious issues in North American field ornithology. A significant part of this problem is due to hybridization among various taxa, a phenomenon especially prevalent in western North America. In particular, Western Gulls (*Larus o. occidentalis*) and Glaucous-winged Gulls (*L. glaucescens*) hybridize extensively from Puget Sound south to central Oregon (Scott 1971, Bell 1996), while Glaucous-winged Gulls and Herring Gulls (*L. argentatus smithsonianus*) hybridize commonly from southwestern Alaska to British Columbia (Williamson and Peyton 1963, Merilees 1974, Patten 1980). Less well-known is the degree of hybridization between Glaucous Gulls (*L. hyperboreus*) and Herring Gulls (Spear 1987) and between Glaucous Gulls and Glaucous-winged Gulls (Swarth 1934, Strang 1977).

Observations on the breeding grounds are the best way to document hybridization, but often these areas are relatively inaccessible—and it is mostly on the nonbreeding grounds where observers are faced with presumed hybrids of uncertain origin. For example, in Marin and Sonoma counties, California, up to 50% of the wintering Western and Glaucous-winged gulls at a site can show hybrid Western × Glaucous-winged characters, while up to 12% of the migrant Herring and Glaucous-winged gulls can show hybrid Herring × Glaucous-winged characters (pers. obs.).

Many adult hybrids can be identified to (presumed) parentage by careful consideration of structure, bare-part colors (especially orbital ring), gray tone of the upperparts, and wing-tip pattern. Immatures, however, are inherently more variable in plumage and pose greater identification challenges. Until the variation in field characters of hybrids—and, indeed, of parent species—is documented and widely appreciated, many problems of identification and distribution will remain unresolved. For example, the distribution and abundance of wintering Thayer's Gulls (*L. thayeri*) in California is clouded by confusion with Herring Gull × Glaucous-winged Gull hybrids. And the field identification of vagrant immature gulls such as the Kumlien's [Iceland] (*L.* [*glaucoides*] *kumlieni*), Vega [Herring] (*L.* [*argentatus*] *vegae*), and Slaty-backed (*L. schistisagus*) in western North America is laced with uncertainty.

The featured photo on the back cover shows an immature gull I photographed at Petaluma, Sonoma County, California, on 27 December 2001. In any gull identification one should first establish the bird's age. This bird looks to be almost entirely in its juvenal plumage, which is typical at this time of year for a first-year individual of the northern-breeding gull species (Howell 2001). But what species (or hybrid combination) is it? Without other species for comparison this bird's size is impossible to judge. Seen by itself this bird could be called a Kumlien's Gull—its bill does not look overly long or bulbous tipped, and the bird looks overall quite similar to several first-winter Kumlien's Gulls I saw in Newfoundland in February 2002. It was with numerous other gulls, however, and was clearly a large and bulky gull—distinctly larger than several Thayer's Gulls present, and comparable in size to Glaucous-winged and Western gulls. In flight it showed no contrasting dark secondary bar, and the primaries had a blended appearance rather than any contrasting darker pattern.

The milky-brown ground color suggests a first-year Glaucous-winged Gull, and the wing-tips are clearly too pale for a Herring Gull or Western Gull, too dark for a Glaucous Gull. But the strongly checkered and lacy-patterned upperparts are atypical of Glaucous-winged Gulls, at least those wintering in central California, bringing us to

the problem of understanding individual variation in a taxon. Could a juvenile pure Glaucous-winged Gull show this patterning? In addition to plumage anomalies, the bill is relatively slender and shows more extensive dull flesh at the base than is typical of first-year Glaucous-winged Gulls at this season. If this is a pure Glaucous-winged Gull it is at the extreme end of the spectrum in several features, and its appearance leads one to consider the possibility of a hybrid.

The relatively small and somewhat parallel-edged bill with fairly extensive dull flesh basally suggests Herring Gull or Glaucous Gull parentage rather than a Glaucous-winged Gull × Western Gull hybrid. A hybrid Herring Gull × Glaucous Gull might be expected to show a more contrasting pinkish bill base and some darker, Herring-like patterning in the primaries—but some known hybrids resemble the bird in the featured photo (e.g., figure 1D of Spear 1987). Many presumed Herring Gull × Glaucous-winged Gull hybrids have darker wings and look like Thayer's Gulls (Howell and Corben 2000), but some, like this bird, more closely resemble Kumlien's Gulls. Its primaries are probably too dark for a hybrid Glaucous Gull × Glaucous-winged Gull, but what solid information do we have to eliminate this option?

Given the present lack of knowledge about individual variation in first-year known Glaucous-winged Gulls and about hybrids, I am unable to identify the bird in the featured photo beyond one of three or four options. This bird exemplifies the problems faced by field observers in western North America and should instill caution in all of us when faced with a problematic gull. I thank Peter Pyle, Martin Reid, and Steve Rottenborn for their review of this note.

LITERATURE CITED

Bell, D. A. 1996. Genetic differentiation, geographic variation, and hybridization in gulls of the *Larus glaucescens–occidentalis* complex. Condor 98:527–546.

Howell, S. N. G. 2001. A new look at moult in gulls. Alula 7:2–11.

Howell, S. N. G., and Corben, C. 2000. Identification of Thayer's-like gulls. The Herring × Glaucous-winged Gull problem. Birders J. 9:25–33.

Merilees, W. J. 1974. A Glaucous-winged Gull mated to a Herring Gull on Okanagan Lake, British Columbia. Can. Field-Nat. 88:485–486.

Patten, S. M. 1980. Interbreeding and evolution in the *Larus glaucescens–Larus argentatus* complex on the south coast of Alaska. PhD thesis, John Hopkins Univ., Baltimore.

Scott, J. M. 1971. Interbreeding of the Glaucous-winged Gull and Western Gull in the Pacific Northwest. Calif. Birds 2:129–133.

Spear, L. B. 1987. Hybridization of Glaucous and Herring gulls at the Mackenzie Delta, Canada. Auk 104:123–125.

Strang, C. A. 1977. Variation and distribution of Glaucous Gulls in western Alaska. Condor 79:170–175.

Swarth, H. S. 1934. Birds of Nunivak Island, Alaska. Pac. Coast Avifauna 22.

Williamson, F. S. L., and Peyton, L. J. 1963. Interbreeding of Glaucous-winged and Herring gulls in the Cook Inlet region, Alaska. Condor 65:24–28.

WESTERN BIRDS

World Wide Web site: www.wfo-cbrc.org

Quarterly Journal of Western Field Ornithologists

President: Mike San Miguel, 2132 Highland Oaks Dr., Arcadia, CA 91006; sanmigbird@aol.com

Vice-President: Daniel D. Gibson, University of Alaska Museum, 907 Yukon Dr., Fairbanks, AK 99775-6960

Treasurer/Membership Secretary: Robbie Fischer, 1359 Solano Drive, Pacifica, CA 94044; robbie22@pacbell.net

Recording Secretary: Kei Sochi, The Nature Conservancy, Western Regional Office, 2060 Broadway, Suite 230, Boulder, CO 80302; ksochi@tnc.org

Directors: Ted Floyd, Kimball L. Garrett, Daniel D. Gibson, Bob Gill, Gjon Hazard, Dave Krueper, Mike San Miguel, W. David Shuford, David Yee

Editor: Philip Unitt, San Diego Natural History Museum, P. O. Box 121390, San Diego, CA 92112-1390; birds@sdnhm.org

Associate Editors: Daniel D. Gibson, Robert A. Hamilton, Ronald R. LeValley, Tim Manolis, Kathy Molina, Mark K. Sogge

Graphics Manager: Virginia P. Johnson, 4637 Del Mar Ave., San Diego, CA 92107

Photo Editor: Peter La Tourrette, 1019 Loma Prieta Ct., Los Altos, CA 92024

Featured Photo: Robert A. Hamiltom, 34 Rivo Alto Canal, Long Beach, CA 90803

Book Reviews: Steve N. G. Howell, Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach, CA 94970

Secretary, California Bird Records Committee: Guy McCaskie, P. O. Box 275, Imperial Beach, CA 91933-0275; guymcc@pacbell.net

Chairman, California Bird Records Committee: Richard A. Erickson, LSA Associates, 1 Park Plaza, Suite 500, Irvine, CA 92614; richard.erickson@lsa-assoc.com

Membership dues, for individuals and institutions, including subscription to Western Birds: Patron, $1000.00; Life, $400 (payable in four equal annual installments); Supporting, $60 annually; Contributing, $34 annually; Family $26; Regular U.S. $22 for one year, $41 for two years, $60 for three years. Dues and contributions are tax-deductible to the extent allowed by law.

Send membership dues, changes of address, correspondence regarding missing issues, and orders for back issues and special publications to the Treasurer. Make checks payable to Western Field Ornithologists.

Back issues of Western Birds within U.S. $24 per volume, $6.00 for single issues, plus $1.00 for postage. Outside the U.S. $30 per volume, $7.50 for single issues.

The California Bird Records Committee of Western Field Ornithologists revised its 10-column Field List of California Birds in January 2000. The last list covered 606 accepted species; the new list covers 613 species. Please send orders to WFO, c/o Robbie Fischer, Treasurer, 1359 Solano Drive, Pacifica, CA 94044. California addresses please add 7.75% sales tax.

Quantity: 1–9, $1.50 each, includes shipping and handling; 10–39, $1.30 each, add $2.00 for shipping and handling; 40 or more, $1.15 each, add $4.00 for shipping and handling.

Published November 30, 2002 ISSN 0045-3897

NEW 80 MM SPOTTING SCOPES

SWAROVSKI... MAKING GOOD THINGS BETTER

Making Good Things Better has been a guiding principle at Swarovski Optik for over 50 years. It's the driving force behind our four, NEW ATS & STS and ATS HD & STS HD, 80 MM Spotting Scopes **This new series of scopes is lighter in weight, smaller in size, armor covered and has a new, brighter resolution,** greater than any other scope on the planet, including the "Premium Reference Standard" AT/ST 80 Scopes they succeed.

The NEW 80's represent the ultimate design effort from the Optical Engineers at Swarovski Optik, and set a new "Optical Reference Standard" for performance in any premium spotting scope. The new scopes are entirely made at the Swarovski Optik factory in Austria. This ensures that full quality control is exercised throughout every step of manufacturing, delivering the finest optical performance backed by our legendary Limited Lifetime Warranty.*

All of the new 20-60X and fixed power eyepieces, camera adapters and accessories are fully interchangeable, producing the same premium resolution and magnification when attached to any of the new family of 65 and 80 MM models.

Call: 800-426-3089, e-mail: info@swarovskioptik.com or visit: www.swarovskioptik.com for your nearest dealer and more information.

SWAROVSKI
OPTIK
WITH THE EYES OF A HAWK

Swarovski Optik North America, Ltd., 2 Slater Road, Cranston, RI 02920

*Original USA warranty card must be postmarked within 30 days of purchase from an authorized Swarovski dealer in good standing.
The registered warranty holder must return entire product with warranty claim.
Note: The "Limited Lifetime USA Warranty" is only available with genuine Swarovski Optik products purchased from an authorized Dealer in good standing.

SWAROVSKI
OPTIK
A Proud Sponsor of Western Field Ornithologists

WESTERN BIRDS

Vol. 33, No. 4, 2002

Western Specialty:
Le Conte's Thrasher

Photo by Joe Fuhrman of Los Angeles, California: Le Conte's Thrasher (*Toxostoma lecontei*), Inyokern, Kern County, California, March 2002.

Volume 33, Number 4, 2002

Abundance and Distribution of Migratory Shorebirds at Mono Lake, California *Emilie A. Strauss, Christine A. Ribic, and W. David Shuford* 222

Composition of Raptors on Espíritu Santo Island, Gulf of California, Mexico *Roberto Carmona, Gorgonio Ruiz-Campos, José Alfredo Castillo-Guerrero, and Efrén Hernández* 241

Noteworthy Waterbird Records in the Delta of the Río Colorado, Mexico, 2002 *Eric Mellink, José Alfredo Castillo-Guerrero, and Aimeé de la Cerda* 249

Nesting Birds of Farallón de San Ignacio, Sinaloa, Mexico *Marco Antonio González-Bernal, Eric Mellink, and José Roberto Fong-Mendoza* 254

NOTES

First Record of Double Brooding by the Common Raven *William C. Webb and Norman C. Ellstrand* 258

A Western Scrub-Jay Preying on Deer Mice *David S. Tinnin* 262

First Record of Leach's Storm-Petrel in the Gulf of California, Mexico *Fernando Puebla-Olivares, Octavio R. Rojas-Soto, and Adolfo G. Navarro S.* 264

Book Review *Steve N. G. Howell* 265

Featured Photo *Steve N. G. Howell and Peter Pyle* 268

Index *Jack W. Schlotte and Philip Unitt* 271

Front cover photo by © Arthur Morris/www.birdsasart.com of Indian Lake Estates, Florida: Masked Booby (*Sula dactylatra*), La Jolla, California, January 2002.

Back cover "Featured Photos" by © Mike Danzenbaker (top) and © Larry Sansone (bottom): Black-bellied Plovers.

Western Birds solicits papers that are both useful to and understandable by amateur field ornithologists and also contribute significantly to scientific literature. The journal welcomes contributions from both professionals and amateurs. Appropriate topics include distribution, migration, status, identification, geographic variation, conservation, behavior, ecology, population dynamics, habitat requirements, the effects of pollution, and techniques for censusing, sound recording, and photographing birds in the field. Papers of general interest will be considered regardless of their geographic origin, but particularly desired are reports of studies done in or bearing on the Rocky Mountain and Pacific states and provinces, including Alaska and Hawaii, western Texas, northwestern Mexico, and the northeastern Pacific Ocean.

Send manuscripts to Kathy Molina, Section of Ornithology, Natural History Museum of Los Angeles County, 900 Exposition Blvd., Los Angeles, CA 90007. For matter of style consult the Suggestions to *Contributors to Western Birds* (8 pages available at no cost from the editor) and the *Council of Biology Editors Style Manual* (available for $24 from the Council of Biology Editors, Inc., 9650 Rockville Pike, Bethesda, MD 20814).

Reprints can be ordered at author's expense from the Editor when proof is returned or earlier.

Good photographs of rare and unusual birds, unaccompanied by an article but with caption including species, date, locality and other pertinent information, are wanted for publication in Western Birds. Submit photos and captions to Photo Editor. Also needed are black and white pen and ink drawings of western birds. Please send these, with captions, to Graphics Manager.

WESTERN BIRDS

Volume 33, Number 4, 2002

ABUNDANCE AND DISTRIBUTION OF MIGRATORY SHOREBIRDS AT MONO LAKE, CALIFORNIA

EMILIE A. STRAUSS, Stillwater Sciences, 2532 Durant Ave., Suite 201, Berkeley, California 94704

CHRISTINE A. RIBIC, U.S. Geological Survey, Wisconsin Cooperative Wildlife Research Unit, Department of Wildlife Ecology, University of Wisconsin, Madison, Wisconsin 53706

W. DAVID SHUFORD, PRBO Conservation Science, 4990 Shoreline Highway, Stinson Beach, California 94970

ABSTRACT: We counted migratory shorebirds and documented their patterns of shoreline distribution at Mono Lake in the Great Basin of California via annual spring and fall surveys from 1989 to 1995. We tallied a total of 30 species, 29 in fall, 25 in spring, and 24 in both seasons. Median counts of all shorebirds were 31,432 (13,901–50,916) in fall and 7792 (2683–25,616) in spring. Median counts exceeded 5000 each for the American Avocet and Wilson's and Red-necked phalaropes in fall and 1000 for the Western and Least sandpipers in spring. Of nine species with median counts of >50 individuals, medians were >50% higher in fall than spring for the American Avocet, Wilson's Phalarope, and Red-necked Phalarope, were >50% higher in spring than fall for the Semipalmated Plover, Western Sandpiper, Least Sandpiper, and Dunlin, and similar in both seasons for the Snowy Plover and Killdeer. The distribution around the lake of total shorebirds and of most individual taxa, except for the Spotted Sandpiper in fall, varied considerably from year to year. Shorebirds as a group as well as most species considered separately concentrated on the south, east, or north shores; except for the Killdeer and Spotted Sandpiper all taxa appeared to avoid the west shore at both seasons. Mono Lake is one of the most important sites for shorebirds in the Intermountain West, particularly for Wilson's and Red-necked phalaropes. Mono Lake's large size, varied habitats, and abundant food are very attractive to shorebirds; habitat availability and food supply are more reliable there than at many sites where they fluctuate widely with variations in climate. A water-rights decision that raises the lake's level likely will improve shorebird habitat, though effects will be mixed.

Widespread declines in shorebird populations in western North America (Page and Gill 1994) emphasize the need to identify and protect important migratory stopovers for this group of birds (Myers et al. 1987, Brown et al. 2000). Although recent studies give broad overviews of shorebird use of

wetlands and agricultural habitats in western North America (Shuford et al. 1998, Page et al. 1999, Shuford et al. 2002), few data have been published on the patterns of shorebird use at individual sites, where most conservation and management efforts will focus.

Mono Lake is well recognized for its critical importance to breeding California Gulls (*Larus californicus*; Shuford and Ryan 2000), Snowy Plovers (*Charadrius alexandrinus*; Page and Stenzel 1981), migratory Eared Grebes (*Podiceps nigricollis*; Boyd and Jehl 1998), and Wilson's (*Phalaropus tricolor*) and Red-necked (*P. lobatus*) phalaropes (Jehl 1986, 1988), yet little is known about the abundance and distribution of most species of shorebirds at the lake. Prior data on shorebird migration at Mono Lake come primarily from five lakewide surveys of waterbirds from 8 July to 14 September 1976 (Winkler et al. 1977) and from localized counts of shorebirds at the Old Marina and South Tufa on 35 and 23 dates, respectively, from 1971 to 1973 (Jurek 1973, 1974). Similarly, prior data on the distribution of shorebirds around Mono Lake are restricted mainly to detailed descriptions for the Red-necked Phalarope (Jehl 1986) and anecdotal ones for other species (Gaines 1992). To add to this knowledge, we counted shorebirds at Mono Lake in spring and fall from 1989 to 1995 as part of PRBO's Pacific Flyway Project.

Here we report the abundance, species composition, and patterns of shoreline distribution of shorebirds at Mono Lake. We also discuss the importance to shorebirds of Mono Lake relative to other sites in the Intermountain West, the implications to shorebird populations of a 1994 water-board decision to raise the lake level substantially, and the need for additional shorebird research at the lake.

STUDY AREA AND METHODS

Mono Lake is a hypersaline terminal lake in eastern California located at the base of the Sierra Nevada at the western edge of the Great Basin. In 1941, the city of Los Angeles diverted streams flowing into Mono Lake. Consequently, the lake fell over 40 vertical feet and doubled in salinity, from 50 grams per liter in 1940 to 100 grams per liter by 1982 (Vorster 1985). Increasing salinity reduced the productivity of brine shrimp (*Artemia monica*) and alkali flies (*Ephydra hians*) (Herbst 1988, 1992; Herbst and Bradley 1993), the primary prey items of aquatic birds using the lake. During our study, the elevation of Mono Lake dropped from 6377.0 feet (1943.7 m) in April 1989 to 6374.1 feet (1942.8 m) in January 1992, then rose to 6377.6 feet (1943.9 m) by August 1995 (Los Angeles Aqueduct Daily Reports).

The length of the Mono Lake shoreline, exclusive of islands, is about 38.0 miles (61.3 km) at a lake elevation of 6378 feet (1944 m). For analysis of distribution, described below, we grouped data from 25 subareas into four larger segments of shoreline: south (13.9 km), east (10.24 km), north (18.99 km), and west (18.17 km) (Figure 1). The south segment was characterized by alkali mudflats, with a relatively long (1–2 km) reach of freshwater marsh, springs, and tufa towers and shoals adjoining the beach at Simon's Springs. The east segment of Mono Lake was dominated by broad alkali mudflats with a few springs whose fresh water flows down to Mono Lake as shallow

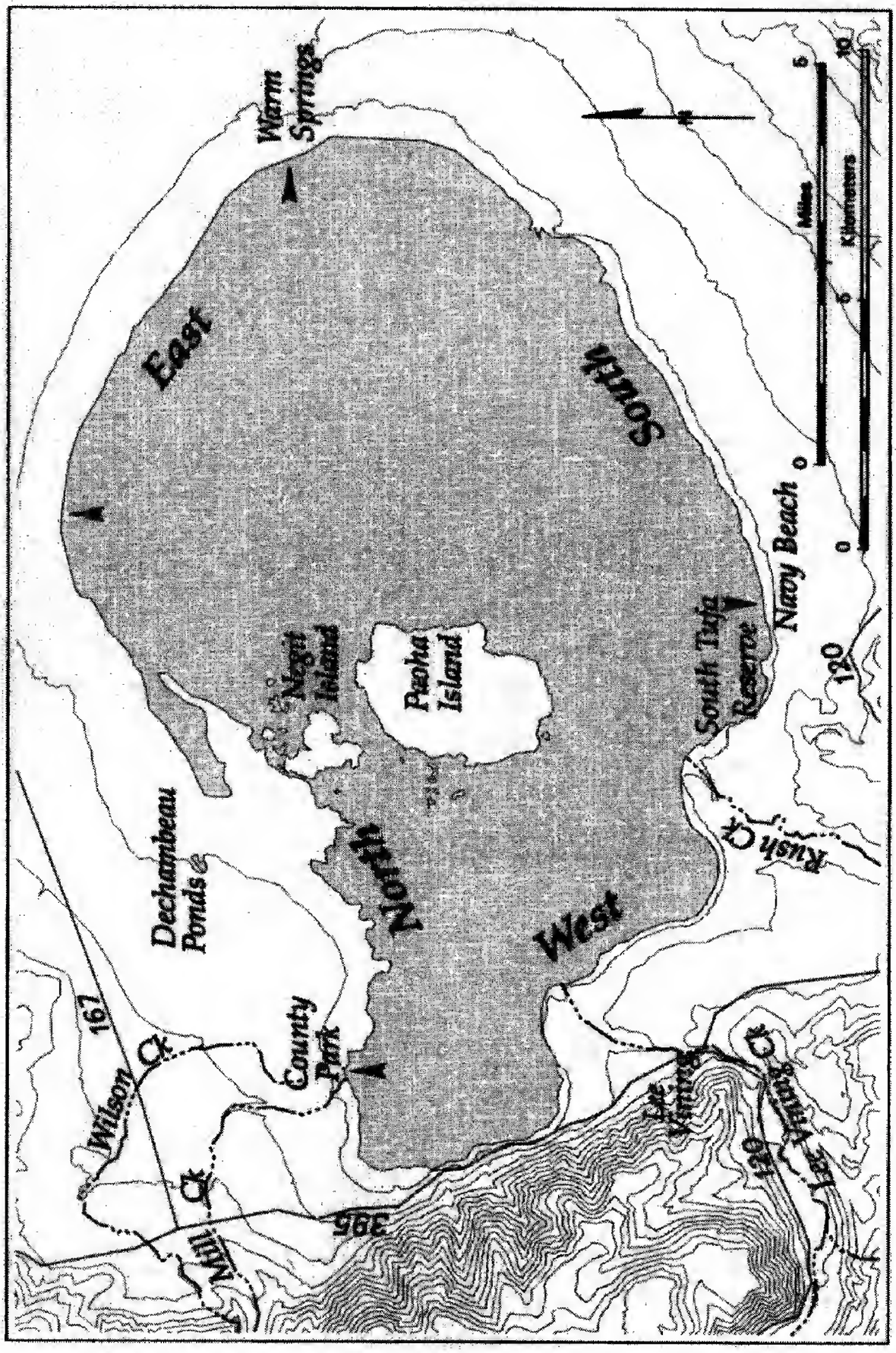


Figure 1. The Mono Lake study area, at a lake elevation of 6378 feet (1944 m), depicting four shoreline segments used for analyses.

laminar sheets and rills. During our study, some rills at Warm Springs ran for 0.4 to 0.8 km before reaching Mono Lake. The north segment consisted mostly of rocky shoals of tufa-encrusted pumice boulders interspersed with patches of mudflat, freshwater marshes, and creek mouths; springs were concentrated at Mono Lake County Park, Wilson Creek delta, and Bridgeport Creek delta (east of Dechambeau Ponds). Man-made Dechambeau Ponds contained fresh water. The west segment consisted primarily of a narrow beach dominated in many sections by sand, cobble, or tufa shoals rather than mud or alkali flats, especially between the Old Marina and Lee Vining Creek, where the steep drop-off provided relatively little shallow-water habitat. Shorebird habitat became more limited on the western shore from 1994 to 1995 when the lake rose and inundated most beaches, which had already narrowed from encroaching vegetation during years of dropping lake level. The lake's two largest freshwater sources, Lee Vining and Rush creeks, flowed into the west segment. A number of large springs also discharged on the western shoreline, but some of these were either surrounded by dense marsh vegetation or did not support shallow-water habitat. During some years, fresh water entering Mono Lake floats on the surface of saline lake water, providing hypopycnal habitat important to phalaropes. Most years, berms of sand created narrow lagoons adjacent to the shoreline; those in the northern portion of the east segment were hypersaline, whereas those along the south shore generally contained fresh or brackish water.

We conducted 14 shorebird counts at Mono Lake, once each spring and fall from 1989 to 1995. Dates of spring counts ranged from 21 April to 6 May, those of fall counts from 13 to 26 August. We selected these dates because they represent peak migratory periods for most shorebird species in the western Great Basin (see Warnock et al. 1998). Our surveys were not timed to coincide with the breeding period of the six species, the Snowy Plover, Killdeer (*Charadrius vociferus*), American Avocet (*Recurvirostra americana*), Spotted Sandpiper (*Actitis macularia*), Wilson's Snipe (*Gallinago delicata*), and Wilson's Phalarope, that nest regularly at the lake in low to moderate numbers (Gaines 1992); the Black-necked Stilt (*Himantopus mexicanus*) is known to have nested only once (B. Miller pers. comm.). We did not conduct winter counts because no shorebirds regularly overwinter, with the exception of very low numbers of the Killdeer, Wilson's Snipe, and Least Sandpiper (*Calidris minutilla*; Gaines 1992).

To cover the long shoreline effectively, we allowed two days for each count. To minimize double counting, we divided observers (generally 10 to 15 per census) into groups of one to three and assigned them to contiguous stretches of lakeshore. Observers, walking parallel to the shore, tallied shorebirds within 25 discrete subareas from 0.8 to 6.8 km in length based on a lake level of 6378 feet (1944.0 m). In a few areas, observers occasionally counted using a telescope from a fixed point. We also usually surveyed Dechambeau Ponds but not the shoreline of any of the lake's islands. We used data from Dechambeau Ponds for tallies of shorebird abundance but not for analysis of distribution patterns around the lake. In most years, but not in fall 1989 and 1990 or spring 1992 and 1995, observers surveyed all or a portion of the land bridge connecting Negit Island to the mainland.

Our surveys provide minimal estimates of numbers of migrating shorebirds because of various limitations to our methods. Lacking adequate numbers of observers, we covered the entire lakeshore only in spring 1994. On other counts, we assigned available observers to areas that shorebirds typically use heavily. Coverage ranged from about 75% to 100% of the shoreline, with the exception of only 60% in spring 1989 and fall 1993. We estimate we probably counted 70% to 90% of all shorebirds present. Access to some areas was restricted by soft mud or quicksand or by massive alkali dust storms (spring 1995). In the falls of 1989 to 1991 and 1993, collaborators counted phalaropes by boat, which has proven the most reliable method for surveying these largely aquatic shorebirds. In these years we substituted the boat tallies of phalaropes for land-based counts; boat counts were on the same weekend as land-based counts in 1990 and 1992 and 8 and 13 days prior in 1989 and 1991, respectively. The protocol for boat counts was described by Jehl (1999).

Because the Flyway Project emphasized the geographic extent of surveys at the expense of their frequency, our twice-annual surveys underestimated the numbers of some early- or late-migrating species. In fall, we generally timed our surveys two to three weeks later than the peak occurrence of the Wilson's Phalarope (Jehl 1988) and about six weeks before the arrival of the Dunlin (*Calidris alpina*; Gaines 1992). In spring, most counts were too early to capture the peak in abundance of phalaropes, which occurs in early to mid-May (Jehl 1986, 1988), or of the Spotted Sandpiper, which is rare as a migrant or summer resident before early May (Gaines 1992). We also underestimated the abundance of some cryptic species that extensively use habitats away from the immediate shoreline of Mono Lake. These include the Snowy Plover and Wilson's Snipe, which use broad alkali flats and lake-fringing marshes, respectively. Similarly, once-per-season surveys may miss peak passage because of natural annual variation (Stenzel and Page 1988, Warnock et al. 1998), particularly in spring when species such as the Western Sandpiper (*C. mauri*), Least Sandpiper, and Long-billed Dowitcher (*Limnodromus scolopaceus*) have very short stopover periods (Warnock and Bishop 1998).

We instructed observers to identify all shorebirds to species when possible. Groups of unidentified shorebirds fell mostly into four categories: yellowlegs, either Greater (*Tringa melanoleuca*) or Lesser (*T. flavipes*); small sandpipers of the genus *Calidris*, primarily Western Sandpipers, Least Sandpipers, or Dunlin; dowitchers, either Short-billed (*Limnodromus griseus*) or Long-billed; and phalaropes, either Wilson's or Red-necked. We assigned unidentified shorebirds to species using methods described by Page et al. (1999), leaving some in unidentified categories when the ratio of unidentified to identified was high. For analyses, we grouped both identified and unidentified dowitchers as dowitcher spp. owing to the difficulty of identifying most individuals to species on surveys.

Data Analysis

To analyze distribution, we selected counts with adequate coverage of the lake's shoreline. For each survey, we tabulated effort per segment (south, west, east, and north) and calculated the proportion of each segment

surveyed. We considered only segments that had at least 70% of their shoreline surveyed as representative of the segment and hence adequate for analysis. Coverage was adequate for all four segments in both spring and fall in 1991, 1992, and 1994, in spring only in 1990. Similarly, sample sizes were adequate for analysis for the Snowy Plover, Semipalmated Plover (*Charadrius semipalmatus*), Killdeer, American Avocet, Spotted Sandpiper, Least/Western sandpipers, Dunlin, and dowitcher spp.

We analyzed data for each species or species group by season. Because not all segments received equal coverage, we adjusted totals for individual species and all shorebirds combined by proportionately reducing counts to the smallest area surveyed in a segment in any year (7.38 km in spring, 8.41 km in fall). This adjusts coverage so it is equivalent across all segments and years in the season, as suggested by Haney (1986) and used by Ribic et al. (1997). *A priori*, we excluded phalaropes from analysis because of varying survey methods among counts and lack of breakdown by shoreline segment on boat surveys.

The null hypothesis was that each species or species group had the same distribution around Mono Lake regardless of year. If there was no evidence that a species' distribution differed from year to year, then data from all years were combined and tested for a uniform distribution around Mono Lake. These hypotheses were tested with log-linear models and standardized residual analysis (Lloyd 1999). The null hypothesis was tested by means of the likelihood-ratio goodness-of-fit statistic (*G*). If the null hypothesis was rejected, standardized residuals showed where data were not fit well by the model. Large positive residuals indicate there are more birds in a segment than expected, whereas large negative residuals indicate fewer birds than expected. Standardized residuals are distributed as normal (0,1) variables, so "large" is a value of 2 or greater and would be considered significant at a probability of 0.05. Residuals less than 2 but greater than 1.6 would be significant at 0.10 and are considered as trends or tendencies. Analyses were done with STATISTICA (StatSoft 1995).

RESULTS

Species Richness and Abundance

We tallied 30 species of shorebirds on our surveys of Mono Lake (Table 1). Of these, we recorded 29 in fall, 25 in spring, and 24 in both seasons. We recorded 6 species every spring and fall and 11 others on every count in just one season (7 in fall, 4 in spring). Median counts of total shorebirds were 31,432 (range 13,901–50,916) in fall and 7792 (range 2683–25,616) in spring. For individual species, median counts were >5000 each for the American Avocet, Wilson's Phalarope, and Red-necked Phalarope in fall and >1000 for the Western and Least sandpipers in spring. Of nine species with median counts of >50 individuals, medians were >50% higher in fall than in spring for the American Avocet, Wilson's Phalarope, and Red-necked Phalarope, were >50% higher in spring than in fall for the Semipalmated Plover, Western Sandpiper, Least Sandpiper, and Dunlin, and similar in both seasons for the Snowy Plover and Killdeer.

Table 1 Numbers of Shorebirds at Mono Lake, California, 1989–1995[a]

Species	Fall[b]				
	19 Aug 1989	25 Aug 1990	24 Aug 1991	15 Aug 1992	22 Aug 1993
Black-bellied Plover *Pluvialis squatarola*	5	8	0	4	0
Snowy Plover *Charadrius alexandrinus*	18	49	31	7	81
Semipalmated Plover *C. semipalmatus*	25	30	8	0	4
Killdeer *C. vociferus*	147	202	32	66	30
Mountain Plover *C. montanus*	0	0	3	0	0
Black-necked Stilt *Himantopus mexicanus*	133	12	22	13	51
American Avocet *Recurvirostra americana*	8467	5398	7652	4520	8999
Greater Yellowlegs *Tringa melanoleuca*	4	9	16	7	4
Lesser Yellowlegs *T. flavipes*	9	11	15	1	3
Yellowlegs spp.	0	0	0	0	0
Solitary Sandpiper *T. solitaria*	1	2	0	0	0
Willet *Catoptrophorus semipalmatus*	31	11	9	4	11
Spotted Sandpiper *Actitis macularia*	43	53	24	15	0
Whimbrel *Numenius phaeopus*	0	0	0	0	0
Long-billed Curlew *N. americanus*	24	24	7	19	1
Marbled Godwit *Limosa fedoa*	3	124	16	2	1
Ruddy Turnstone *Arenaria interpres*	2	0	1	0	0
Red Knot *Calidris canutus*	3	0	0	0	4
Sanderling *C. alba*	0	6	1	0	0
Semipalmated Sandpiper *C. pusilla*	0	0	1	0	0
Western Sandpiper *C. mauri*	639	3573	3171	490	272
Least Sandpiper *C. minutilla*	204	1244	527	24	410
Western/Least Sandpiper	226	634	10	0	0
Baird's Sandpiper *C. bairdii*	19	31	19	2	7
Pectoral Sandpiper *C. melanotos*	0	0	0	0	2
Dunlin *C. alpina*	0	0	0	0	12
Western/Least/Dunlin	0	0	0	0	0
Dowitchers *Limnodromus* spp.[c]	28	46	27	4	20
Wilson's Snipe *Gallinago delicata*	2	7	2	2	0
Wilson's Phalarope *Phalaropus tricolor*	4500	478	10,000	1420	9000
Red-necked Phalarope *Phalaropus lobatus*	19,000	6320	18,000	5981	12,520
Red Phalarope *Phalaropus fulicarius*	0	0	0	0	0
Phalarope spp.	0	1050	0	510	0
Total shorebirds	33,533	19,322	39,594	13,091	31,432

		Spring						
13 Aug 1994	12 Aug 1995	22 Apr 1989	21 Apr 1990	27 Apr 1991	25 Apr 1992	1 May 1993	5 May 1994	29 Apr 1995
40	50	4	49	11	14	0	0	1
87	216	35	81	88	56	135	101	23
6	16	286	178	244	70	128	159	133
153	48	67	97	64	23	25	65	30
0	0	0	0	0	0	0	0	0
55	0	21	11	1	17	8	82	0
10,999	2191	1564	650	353	805	317	425	15
4	1	9	6	2	2	0	3	6
10	1	0	0	0	0	1	0	0
1	0	1	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0
35	9	0	0	4	50	3	6	9
49	7	4	4	5	1	10	209	3
0	0	1	0	0	2	0	4	0
43	7	2	0	0	0	1	0	2
16	5	0	0	19	0	36	0	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	3	0	0	0
0	3	0	0	0	0	0	14	0
0	0	0	0	0	0	0	0	0
725	1129	14,217	18,640	1178	4939	1482	8921	1952
196	305	1298	4693	3243	1178	329	188	148
1	0	1810	584	1989	0	108	0	0
27	18	0	0	3	0	0	0	0
0	0	0	0	0	0	0	0	0
0	1	183	430	313	263	88	725	325
0	0	540	0	0	0	0	0	
27	30	297	22	39	100	8	11	22
1	7	5	3	22	5	4	7	7
5478	46,542	126	61	33	51	852	764	7
1113	75	64	0	179	4	9	129	0
0	5	0	0	0	0	0	0	0
0	250	0	106	2	4	35	675	0
19,071	50,916	20,534	25,616	7792	7587	3579	12,488	2683

[a]Dates represent the first day of a two-day count period.

[b]Phalarope data from boat counts on 11 August 1989, 26 August 1990, 11 August 1991, and 22 August 1993 and from land-based counts on all other surveys. These counts tended to greatly underestimate numbers of Wilson's Phalaropes because they were two to three weeks later than the normal peak passage for that species.

[c]Long-billed (*L. scolopaceus*) and Short-billed (*L. griseus*) dowitchers were recorded in both fall and spring.

Table 2 Likelihood-Ratio Goodness-of-Fit Statistics Relative to the Null Hypothesis That Each Shorebird Taxon Had the Same Distribution around Mono Lake Regardless of Year

	Fall			Spring		
Species	*G*	df	*p*	*G*	df	*p*
Total shorebirds	1522	6	<0.001	4642	9	<0.001
Snowy Plover	17.3	6	0.008	45.9	9	0.02
Semipalmated Plover	—	—	—	107	9	<0.001
Killdeer	3.3	6	0.8	45	9	<0.001
American Avocet	1959	6	<0.001	353	9	<0.001
Spotted Sandpiper	0.5	6	0.9	—	—	—
Least/Western sandpipers	787	6	<0.001	4642	9	<0.001
Dunlin	—	—	—	15.4	6	0.02
Dowitcher spp.	—	—	—	58	9	<0.001

Lakewide Distribution Patterns

The distribution around the lake for total shorebirds, American Avocets, and Least/Western sandpipers varied considerably from year to year in both spring and fall, for the Snowy Plover, Semipalmated Plover, Dunlin, and dowitchers in spring, and for the Killdeer in spring but not fall (Table 2). The Spotted Sandpiper showed the most predictable pattern, as its distribution in fall did not vary from year to year.

Analyses by year showed that, in spring, shorebirds as a whole concentrated in numbers greater than expected in the south and east, as did the Semipalmated Plover, Least/Western sandpipers, and Dunlin (Table 3). In fall, shorebirds as a whole generally concentrated in numbers higher than expected in the east and north, as did the American Avocet and Least/Western sandpipers (Table 3). Shorebirds as a group occurred in numbers lower than expected in the west in both seasons (Table 3). Except for the Killdeer and Spotted Sandpiper, all species occurred in numbers lower than expected in the west in both seasons. The Killdeer occurred in numbers higher than expected in the west but generally in numbers lower than expected in the north and east. The exception was in spring 1991, when the Killdeer occurred in higher numbers in the east. In fall, the Spotted Sandpiper consistently occurred in numbers higher than expected in the west and in numbers lower than expected in the east and north.

Some individual species had additional distribution patterns of interest. In spring, the Snowy Plover consistently occurred in numbers greater than expected in the east and sometimes the south, the Semipalmated Plover mostly in the south and sometimes in the east, Least/Western sandpipers and Dunlin in the south and east, and dowitchers mostly in the east. Patterns for the American Avocet were among the most variable with numbers greater than expected mostly in the south in spring and the north and east in fall.

DISCUSSION

Despite their limitations, our surveys greatly expanded the knowledge of the species composition, abundance, and distribution of migrant shorebirds at Mono Lake. Our peak counts of American Avocets and Western Sandpipers, for example, are about three and nine times greater, respectively, than any prior counts (Jurek 1973, Winkler et al. 1977, Winter and Manolis 1978). We added little information, however, on phalaropes. Jehl (1999) reported counts of Wilson's Phalaropes at Mono Lake averaging about 55,000 (maximum 70,000) in the early to mid-1980s, declining to 2100 by 1992, and increasing again to about 38,000 in 1997. In fall our counts were too late in the season for peak numbers and hence are not comparable to Jehl's. In 1989, our land-based count on 12–13 August of 46,542 Wilson's Phalaropes was anomalous in that it exceeded Jehl's (1999) boat count of 34,800 taken that year during the typical period of peak numbers from 25 July to 3 August. Jehl's (1986) peak counts of Red-necked Phalaropes at Mono Lake from 1981 to 1984 ranged from 8000 to 14,000; on the basis of turnover he estimated 52,000 to 65,000 passed through each fall. Our comparable boat counts for the Red-necked on single dates in 1989, 1991, and 1993 ranged from 12,520 to 19,000. The highest estimate for this species at Mono Lake on a single date was >40,000 on 22 August 1958 (H. Cogswell in Jehl 1986).

Importance of Mono Lake

A combination of our data, for various shorebirds, and Jehl's (1986, 1988), for phalaropes, led to designation of Mono Lake as a site of international importance within the Western Hemisphere Shorebird Reserve Network (Harrington and Perry 1995). International sites annually support at least 100,000 shorebirds or 15% of a species' flyway population. Within the entire Intermountain West, Mono Lake is one of only 10 sites that hold >10,000 shorebirds in fall (Shuford et al. 2002) and, along with Great Salt Lake and Lake Abert, is one of the three most important sites for Wilson's and Red-necked phalaropes (Jehl 1986, 1988; Shuford et al. 2002). Mono Lake also is one of the most important sites in the interior of California for breeding Snowy Plovers (Page et al. 1991).

Mono Lake is very important to shorebirds because of its large size, long shoreline with varied habitats, and extremely abundant prey base of brine shrimp and alkali flies. Mono Lake is also a critical habitat because it is relatively deep yet its shallows provide mudflats and alkali flats in both wet and dry periods. By contrast, many wetlands in the arid Great Basin offer shorebirds habitat only in periods of above-average precipitation (Reed et al. 1997, Warnock et al. 1998, Plissner et al. 2000). Conversely, other important shorebird sites along the east side of the Sierra Nevada, such as Crowley Lake and Bridgeport Reservoir, are not attractive to most shorebirds during very wet years when high water levels inundate mudflats (E. Strauss pers. obs.).

Table 3 Standardized Residuals for Models of Distributions of Shorebirds around Mono Lake by Year[a]

Species		Segment			
		South	East	North	West
Total Shorebirds					
Spring	1990	**52**	−28.8	**35.6**	−58.7
	1991	**5.9**	**50**	−22.2	−33.6
	1992	**31.0**	**8.5**	−8.5	−30.9
	1994	**29.5**	**26.3**	−13.1	−42.8
Fall	1991	**10.6**	**36**	—	−45
	1992	—	**4.2**	**25**	−28
	1994	−17.1	**7.6**	**46**	−37
Snowy Plover					
Spring	1990	**3.3**	**2.3**	—	−4
	1991	−2.2	**11**	−4.2	−4.4
	1992	—	**4.5**	—	−3.5
	1994	**3.0**	**3.2**	−2	−4.2
Semipalmated Plover					
Spring	1990	**12**	−3.2	−3.1	−5.7
	1991	**5.1**	**6.4**	−5.4	−6.1
	1992	**6.5**	—	−3.8	−3.8
	1994	−2	**11.4**	−3.5	−5.9
Killdeer					
Spring	1990	—	−3.7	−3.2	**6.8**
	1991	—	**3.2**	−2.3	—
	1992	—	—	−2.0	**4**
	1994	—	−2.8	—	**4.4**
Fall	1991–94[b]	—	−5.5	—	**4.3**
American Avocet					
Spring	1990	**23**	−4.8	−6.9	−11
	1991	—	**2.9**	**3.8**	−6.2
	1992	**7.1**	−8.5	**11.3**	−9.9
	1994	**18.3**	−7.5	−2.6	−8.1

(continued)

Food Preference and Availability

Except for phalaropes and Snowy Plovers, very little is known about the food preferences of shorebirds at Mono Lake or elsewhere in the Great Basin (Warnock et al. 1997). Wilson's Phalaropes depend on both brine shrimp and alkali flies when staging at Mono Lake in fall, and their diet varies by sex and age (Jehl 1988). Snowy Plovers rely on alkali flies and a carabid beetle (*Bembidion ephippigerum*; Swarth 1983). Red-necked Phalaropes feed mostly on alkali flies (Jehl 1986) and cannot subsist on a diet of brine shrimp alone (Rubega and Inouye 1994). Mahoney and Jehl (1985) reported that samples of three stomachs of the American Avocet at Mono Lake contained only adult alkali flies, although Robinson et al. (1997) reported that at saline inland wetlands brine shrimp were also important. On the California coast, Ramer et al. (1991) found Western Sandpipers feeding

Table 3 *(Continued)*

Species		Segment			
		South	East	North	West
Fall	1991	**23.3**	**19.9**	–5.3	–38
	1992	—	**7.8**	**20**	–27
	1994	–17.7	—	**54**	–34.5
Least/Western sandpipers					
Spring	1990	**48**	–30	**38**	–57
	1991	**8.5**	**44**	–21	–31
	1992	**30**	**10**	–13	–28
	1994	**26**	**27**	–11	–42
Fall	1991	–14	**34**	**5.4**	–25
	1992	–4.2	–8.8	**20**	–7.2
	1994	–4.7	**29**	–11	–14
Spotted Sandpiper					
Fall	1991–94[b]	—	–2.9	–2.1	**6.5**
Dunlin[c]					
Spring	1990	**4.8**	**7.3**	–2.9	–9.2
	1992	**4.3**	3.6	—	–7.3
	1994	**11**	**7.1**	–6.3	–12
Dowitcher spp.[d]					
Spring	1990	—	**3.8**	—	—
	1991	–2.6	**3.4**	—	—
	1992	—	–4.0	**7.3**	–4.0

[a]Numbers in bold and Roman type are those for which counts were significantly greater and lower than expected, respectively, under the null hypothesis that, within a year, the distribution around the lake was uniform. Dashes indicate nonsignificant residuals. Significance was assessed at $p < 0.05$.

[b]No evidence was found that the pattern of distribution differed by years, hence data for all years were pooled and tested for a uniform distribution around the lake.

[c]No Dunlins were recorded in spring 1991.

[d]The number of dowitchers recorded in spring 1994 was too low to analyze.

predominantly on ephydrid fly larvae and pupae, suggesting that at Mono Lake ephydrids, such as alkali flies, may provide an important food source.

Variation in Shorebird Abundance and Species Richness

Shorebird numbers at Mono Lake varied substantially from year to year. This may reflect annual differences in habitat availability elsewhere in the western Great Basin, north-to-south variation in climatic conditions, annual variation in the period of peak migration, or annual fluctuations in sizes of shorebird populations. Warnock et al. (1998) and Shuford et al. (2002) also found large annual fluctuations in shorebird totals at other western Great Basin sites.

In all years except 1991, shorebird totals at Mono Lake were greater in fall than spring. This difference most likely reflects great seasonal fluctuations in

the availability of brine shrimp and alkali flies, which attract large numbers of American Avocets and phalaropes to the lake. Although little is known about other shorebirds' food preferences at Mono Lake, prey are probably limited at Mono Lake during April but abundant during most years in August. During April, brine shrimp are immature and not large enough for shorebirds to eat (R. Jellison pers. comm.), and densities of alkali fly larvae, pupae, and adults are low (Lenz 1984, Herbst 1988). During most years, brine shrimp have grown to a size appropriate for shorebirds by late May or June (Lenz 1984, Jehl 1988).

In California, species richness of shorebirds is often slightly higher in fall than in spring because of the presence in fall of juveniles of some species that are rare to absent in spring (Page et al. 1979, Shuford et al. 1989). At Mono Lake, we observed six species—the Mountain Plover (*Charadrius montanus*), Ruddy Turnstone (*Arenaria interpres*), Sanderling (*Calidris alba*), Semipalmated (*C. pusilla*), and Pectoral (*C. melanotos*) sandpipers, and Red Phalarope (*Phalaropus fulicarius*)—during fall surveys only.

Distribution Relative to Habitat Use

During our studies, shorebirds were distributed around Mono Lake nonuniformly, reflecting in part the arrangement of various habitats. Most species, except the Killdeer and Spotted Sandpiper, occurred more than expected on either the south, east, or north shores. A large proportion of shorebirds appeared to be attracted to the juxtaposition of alkali mudflats and freshwater springs found in all but the west segment.

Although substantial numbers of shorebirds used dry alkali mudflats near the edge of Mono Lake, the majority, especially *Calidris* sandpipers, concentrated near rills, especially those at Warm and Simon's springs. Another habitat feature that attracted shorebirds was a set of shallow freshwater pools that formed most years at the mouth of Wilson Creek and along the south segment. Most shorebirds on the north segment also concentrated at freshwater sites. In 1994 and 1995, Mono Lake's level rose and inundated much of the shoreline between Navy Beach and Simon's Springs. The remaining narrow beach tended to support fewer shorebirds, though some shorebird use here shifted to narrow lagoons created by flooding from the rising lake.

The west segment typically had less shorebird habitat than the others, and what was there did not attract large concentrations. The Killdeer and Spotted Sandpiper, the only species occurring at a frequency higher than expected in the west segment, use primarily gravel bars and other hard substrates, a predominant habitat in this area. The Spotted Sandpiper, in particular, typically associates with deltas of freshwater streams (Gaines 1992) and gravelly or cobbly beaches. The Killdeer is often found on gravel bars (Jackson and Jackson 2000), especially those adjacent to fresh water (D. Shuford pers. obs.). The creek deltas, as well as mudflats below the Old Marina and southern portion of Mono County Park, attracted most of the other shorebird species in the west segment.

Most of the species commonly associated with muddy margins of lakes, such as the Semipalmated Plover, Western and Least sandpipers, and

Dunlin (Gaines 1992), used primarily the south, east, and north segments, rarely the west segment. Page et al. (1983) observed Snowy Plovers feeding either along the shore of Mono Lake or at seeps, which is consistent with our observations. Like most migrant shorebirds at the lake, dowitchers were attracted to muddy lake margins (Gaines 1992) on the south, east, and north shores, but they also use narrow mudflats adjacent to marshes and freshwater pools on the west shore. American Avocets, which feed on flies and shrimp obtained by wading in shallow water (Robinson et al. 1997), were often observed in areas away from sources of fresh water, such as the Negit Island land bridge.

Our anecdotal observations showed that phalaropes concentrated offshore except in fall 1995, when large numbers roosted and preened on alkali flats at the lake's edge. Wilson's Snipe used primarily freshwater marshes on the lake's western shore.

Fresh water is extremely important to shorebirds in a hypersaline environment such as Mono Lake. Although shorebirds have developed adaptations to avoid stress, such as excreting excess salt through salt glands and kidneys, avoiding ingestion of saltwater, choosing prey low in salt, manipulating or straining prey to minimize salt ingestion, and visiting fresh water to drink and bathe (Rubega and Robinson 1997), these behaviors consume energy and can reduce fitness. At Mono Lake fresh water is clearly important to Wilson's and Red-necked phalaropes, Least and Western sandpipers, and California Gulls for drinking and bathing (Mahoney and Jehl 1985; Jehl 1986, 1988; Rubega and Robinson 1997). Mahoney and Jehl (1985) indicated that Wilson's Phalaropes and American Avocets probably require limited fresh water when at Mono Lake because they avoid some salt loading by using the tongue and bill to squeeze lake water from prey items before ingestion. During the last several weeks of their fall visit, Wilson's Phalaropes escalate feeding rates to put on fat for a nonstop flight to South America; during this hyperphagic period they may inadvertently swallow additional lake water and thus require fresh water as often as twice a day (Mahoney and Jehl 1985, Jehl 1997). During the 1980s when Mono Lake's salinity was especially high, Jehl (1988) observed up to 50,000 Wilson's Phalaropes bathing and drinking at Mono Lake in the deltas of streams and springs. Red-necked Phalaropes also visit fresh water (Winkler et al. 1977).

Future Prospects

Concern over ecosystem collapse from increasing salinity was largely alleviated by a water-rights decision that mandated allowing Mono Lake to rise over 20 years to a dynamic equilibrium centered around a lake level of 6391 feet (1943 m; SWRCB 1994a). If water diversions had continued, hypersalinity would have greatly reduced the abundance of alkali flies and brine shrimp and increased the energetic cost of salt excretion and prey manipulation by shorebirds.

Changing habitat conditions as the lake rises to reach dynamic equilibrium should affect patterns of shorebird use. Most shorebird species likely will benefit from an increase in food. Herbst and Bradley (1993) predicted that alkali fly abundance will increase because of a reduction in salinity and an

increase in submerged hard substrate used as attachment sites by fly pupae. Brine shrimp abundance also is expected to increase (Dana and Lenz 1986). Immediately after the decision to restrict water diversions and raise the lake level these long-term benefits of less saline conditions were partially offset when a large influx of fresh water in 1995 initiated an episode of meromixis or persistent salinity stratification (Jellison et al. 1998). The absence of a winter period of holomixis (complete mixing) and stronger density stratification in summer reduces internal recycling of nutrients and algal and zooplankton productivity (Jellison and Melack 1993a). A similar episode of meromixis was initiated by exceptionally high runoff in 1983 (Jellison and Melack 1993b). As during the earlier (1983–1988) episode, however, three years (2000–2002) of modest declines in lake level have resulted in weakening of meromixis and a return to average levels of productivity even prior to its breakdown (R. Jellison pers. comm.). The lake is currently well mixed above a depth of 28 m. While meromixis is expected to break down in 2003, productivity is predicted to remain near or above average even if it persists (R. Jellison pers. comm.).

Most types of shorebird habitat will likely increase in abundance and quality, except that mudflats may contract somewhat. Inundation of protected coves by the rising lake will allow fresh water to form a hypopycnal layer over denser, more saline lake water (Stine 1995), benefiting phalaropes by providing additional sources for drinking and bathing. Ephemeral brackish lagoons are expected to expand, but some of them will be surrounded by dense marsh vegetation; freshwater pond acreage will remain about the same (Stine 1995). Wilson's Snipe will likely lose breeding habitat as freshwater marshes and seasonal wet meadows are inundated by the rising lake; still, marshes will remain more extensive than at prediversion levels. The total length of shoreline will increase (SWRCB 1994b), but not all of it will be available to shorebirds. During our study the width of alkali mudflats decreased on the south and west shores as the lake rose, but on the north and east shores habitat was still abundant. The extent of mudflat will vary as the lake reaches and fluctuates around the dynamic equilibrium, reducing habitat during wet periods over that available to shorebirds during our study. There will also be seasonal variation in the lake level. In April, the lake is generally relatively low, and substantial mudflats should be available (S. Stine pers. comm.). During most years, by August snowpack runoff will have raised the lake level, and mudflats may be less available than in April, especially along the western shore. It is unclear if the suitability of alkali flats and mudflats will be altered, as some springs will migrate upslope of the existing lake level, whereas others will become sublacustrine. Shallow water should remain abundant (S. Stine pers. comm.). Although the acreage of alkali flats will decline, it will stabilize at a level high enough to provide ample habitat for maintaining Snowy Plover populations (SWRCB 1994b:4-99).

If shoreline access and human disturbance increase, shorebirds feeding at the lake edge and roosting phalaropes could be affected negatively (e.g., Pfister et al. 1992, Burger et al. 1995). Foraging phalaropes may be disturbed if recreational boating increases.

Research and Monitoring Needs

Long-term monitoring is critical to assessing shorebirds' response to changes in lake levels and the potential effects of human disturbance. Understanding population changes at the lake will be possible, though, only within the context of information from broader efforts to assess continental populations, which likewise will be aided by monitoring at Mono Lake. Knowledge of shorebirds at Mono Lake could be enhanced by studies that better document seasonal use patterns via more frequent surveys, determine the migratory pathways of shorebirds passing to and from Mono Lake, investigate the diet of poorly known species, and assess the relation of prey availability to shorebird concentrations. Research, monitoring, and management at Mono Lake should be coordinated with similar efforts throughout the Intermountain West (Oring et al. 2000).

ACKNOWLEDGMENTS

The Pacific Flyway Project was funded by the Bay Foundation of Morro Bay, the Bradford Foundation, the Bureau of Reclamation, the Central Valley Habitat Joint Venture, Chevron USA Inc., the Dakin Foundation, Ducks Unlimited, the Katherine W. Dumke and Ezekiel R. Dumke, Jr. Foundation, Genentech, the Walter and Elise Haas Fund, the J. M. Long Foundation, the Marin, Morro Coast, and Stockton chapters of National Audubon Society, the National Fish and Wildlife Foundation, the David and Lucille Packard Foundation, the San Francisco Foundation, the Strong Foundation, the True North Foundation, the Dean Witter Foundation, anonymous donors, and members of PRBO. Gary Page provided inspiration and guidance for the Pacific Flyway Project, Janet Kjelmyr helped with data summary, and Lynne Stenzel offered suggestions for data analysis. We would especially like to thank Joseph R. Jehl, Jr., Margaret Rubega, and associates for sharing their data from boat counts of phalaropes. We are grateful to the following individuals for participating in shorebird counts: Sy Baldwin, Reuben Balzer, Lynn Berner, Andy Bradvica, Jane Broer, John Cain, Dave and Janet Carle, Chris Corben, Bob Damschroeder, Claudia Davison, Susan Desbaillets, Jan Dierks, Deanna Dulen, Kathy Duvall, Joel Ellis, Chris Elphick, Melanie Findling, Larry Ford, Steve Glover, Paul and Helen Green, Tina Hargis, Emily Hart, Patrick Heimgartner, Dave Herbst, Catherine Hickey, Tom and Rosanne Higley, Steve Holland, Eva Howarth, Lisa Hug, Joan Humphrey, Bruce Inman, Caron Inouye, Emily Johnson, Bridget Keinel, Dan Keller, Donald Keller, John Keller, Dave Marquart, Mike McClaskey, Bev McIntosh, Randy McPheron, Geoff McQuilkin, Peter Metropulos, Nancy Metzer, Patrick Mitchell, Jason Montiel, Francis Moore, Ron and Lisa Nelson, Bryan Obst, Ginelle O'Connor, Jim and Debby Parker, Lina Prairie, Michael Prather, Bob Richmond, Ed Rodriguez, Steve Schmidt, Patricia Suppa, Curt Sutliffe, Sarah Taylor, Paul Todd, Brian Voll, Tracy Westphal, Judy Wickman, Denise Wight, and David Wimpfheimer. Larry Ford (USDA Forest Service) and Dave Marquart (Mono Basin State Tufa Reserve) provided 4-wheel drive transportation to remote parts of Mono Lake. Steve Barager, Joel Ellis, Ilene Mandelbaum, and Emily and Dale Johnson provided logistical support, Bryan Flaig contributed computer expertise, Robert Jellison calculated brine shrimp lengths, Bartshe Miller contributed information on shorebird status and abundance, Scott Stine calculated the length of shorebird survey segments, Rusty Scalf kindly drafted Figure 1, and Stillwater Sciences contributed staff time to manuscript preparation. This is contribution 940 of PRBO.

LITERATURE CITED

Boyd, W. S., and Jehl, J. R., Jr. 1998. Estimating the abundance of Eared Grebes on Mono Lake, California, by aerial photography. Colonial Waterbirds 21:236–241.

Brown, S., Hickey, C., and Harrington, B., eds. 2000. The U.S. Shorebird Conservation Plan. Manomet Center for Conservation Sciences, P.O. Box 1770, Manomet, MA 02345.

Burger, J., Gochfeld, M., and Niles, L. J. 1995. Ecotourism and birds in coastal New Jersey: Contrasting responses of birds, tourists and managers. Environmental Conserv. 22:56–65.

Dana, G. L., and Lenz, P. H. 1986. Effects of increasing salinity on an *Artemia* population from Mono Lake, California. Oecologia 68:428–436.

Gaines, D. 1992. Birds of Yosemite and the East Slope, 2nd ed. Artemisia Press, Lee Vining, CA.

Haney, J. C. 1986. Seabird segregation at Gulf Stream frontal eddies. Mar. Ecol. Prog. Ser. 28:279–285.

Harrington, B., and Perry, E. 1995. Important shorebird staging sites meeting Western Hemisphere Shorebird Reserve Network criteria in the United States. U.S. Dept. Inter., Fish and Wildl. Serv., Washington, D.C.

Herbst, D. B. 1988. Comparative population ecology of *Ephydra hians* Say (Diptera: Ephydridae) at Mono Lake (California) and Abert Lake (Oregon). Hydrobiologia 158:145–166.

Herbst, D. B. 1992. Changing lake level and salinity at Mono Lake: Habitat conservation problems for the benthic alkali fly, in The History of Water (C. Hall, Jr., V. Doyle-Jones, and B. Widawski, eds.), pp. 198–210. Univ. Calif. White Mtn. Research Station Symposium, vol. 4. White Mtn. Res. Sta., Bishop, CA 93514.

Herbst, D. B., and Bradley, T. J. 1993. A population model for the alkali fly at Mono Lake: Depth distribution and changing habitat availability. Hydrobiologia 267:191–201.

Jackson, B. J. S., and Jackson, J. A. 2000. Killdeer (*Charadrius vociferus*), in The Birds of North America (A. Poole and F. Gill, eds.), no. 517. Birds N. Am., Philadelphia.

Jehl, J. R., Jr. 1986. Biology of Red-necked Phalaropes (*Phalaropus lobatus*) at the western edge of the Great Basin in fall migration. Great Basin Nat. 46:185–197.

Jehl, J. R., Jr. 1988. Biology of the Eared Grebe and Wilson's Phalarope in the nonbreeding season: A study of adaptation to saline lakes. Studies Avian Biol. 12.

Jehl, J. R., Jr. 1997. Fat loads and flightlessness in Wilson's Phalaropes. Condor 99:538–543.

Jehl, J. R., Jr. 1999. Population studies of Wilson's Phalaropes at fall staging areas, 1980–1997: A challenge for monitoring. Waterbirds 22:37–46.

Jellison, R., and Melack, J. M. 1993a. Meromixis in hypersaline Mono Lake, California. I. Vertical mixing and density stratification during the onset, persistence, and breakdown of meromixis. Limnol. Oceanogr. 38:1008–1019.

Jellison, R., and Melack, J. M. 1993b. Algal photosynthetic activity and its response to meromixis in hypersaline Mono Lake, California. Limnol. Oceanogr. 38:818–837.

Jellison, R., Romero, J., and Melack, J. M. 1998. The onset of meromixis during restoration of Mono Lake, California: Unintended consequences of reducing water diversions. Limnol. Oceanogr. 41:706–711.

Jurek, R. M. 1973. California shorebird study project final report. Calif. Dept. Fish & Game, 1416 Ninth St., Sacramento, CA 95814.

Jurek, R. M. 1974. California shorebird survey 1969–1974. Spec. Wildl. Invest. Rept., Project W-54-R, Job III-1. Calif. Dept. Fish & Game, 1416 Ninth St., Sacramento, CA 95814.

Lenz, P. H. 1984. Life-history analysis of an *Artemia* population in a changing environment. J. Plankt. Res. 6:967–983.

Lloyd, C. J. 1999. Statistical Analysis of Categorical Data. Wiley, New York.

Mahoney, S. A., and Jehl, J. R., Jr. 1985. Adaptations of migratory shorebirds to highly saline and alkaline lakes: Wilson's Phalarope and American Avocet. Condor 87:520–527.

Myers, J. P., Morrison, R. I. G., Antas, P. Z., Harrington B. A., Lovejoy, T. E., Sallaberry, M., Senner, S. E., and Tarak, A. 1987. Conservation strategy for migratory species. Am. Sci. 75:19–26.

Oring, L. W., Neel, L., and Oring, K. E. 2000. Intermountain West regional shorebird plan, version 1.0. Regional report of the U.S. Shorebird Conservation Plan. Manomet Center for Conservation Sciences, P.O. Box 1770, Manomet, MA 02345 (http://www.manomet.org).

Page, G. W., and Gill, R. E., Jr. 1994. Shorebirds in western North America: Late 1800s to late 1900s. Studies Avian Biol. 15:147–160.

Page, G. W., and Stenzel, L. E., eds. 1981. The breeding status of the Snowy Plover in California. W. Birds 12:1–40.

Page, G. W., Stenzel, L. E., and Kjelmyr, J. E. 1999. Overview of shorebird abundance and distribution in wetlands of the Pacific coast of the contiguous United States. Condor 101:461–471.

Page, G. W., Stenzel, L. E., Shuford, W. D., and Bruce, C. R. 1991. Distribution and abundance of the Snowy Plover on its western North American breeding grounds. J. Field Ornithol. 62:245–255.

Page, G. W., Stenzel, L. E., Winkler, D. W., and Swarth, C. W. 1983. Spacing out at Mono Lake: Breeding success, nest density, and predation in the Snowy Plover. Auk 100:245–255.

Page, G. W., Stenzel, L. E., and Wolfe, C. M. 1979. Aspects of the occurrence of shorebirds on a central California estuary. Studies Avian Biol. 2:15–32.

Pfister, C., Harrington, B. A., and Lavine, M. 1992. The impact of human disturbance on shorebirds at a migration staging area. Ecol. Conserv. 60:115–126.

Plissner, J. H., Haig, S. M., and Oring, L. W. 2000. Postbreeding movements of American Avocets and implications for wetland connectivity in the western Great Basin. Auk 117:290–298.

Ramer, B. A., Page, G. W., and Yoklavich, M. M. 1991. Seasonal abundance, habitat use, and diet of shorebirds in Elkhorn Slough, California. W. Birds 22:157–174.

Reed, J. M., Warnock, N., and Oring, L. W. 1997. Censusing shorebirds in the western Great Basin of North America. Int. Wader Studies 9:29–36.

Ribic, C. A., Ainley, D. G., and Spear, L. B. 1997. Scale-related seabird–environmental relationships in Pacific equatorial waters, with reference to El Niño–Southern Oscillation events. Mar. Ecol. Prog. Ser. 156:183–203.

Robinson, J. A., Oring, L. O., Skorupa, J. P., and Boettcher, R. B. 1997. American Avocet (*Recurvirostra americana*), in The Birds of North America (A. Poole and F. Gill, eds.), no. 275. Birds N. Am., Philadelphia.

Rubega, M., and Inouye, C. 1994. Prey switching in Red-necked Phalaropes *Phalaropus lobatus*: Feeding limitations, the functional response and water management at Mono Lake, California, USA. Biol. Conserv. 70:205–210.

Rubega, M. A., and Robinson, J. A. 1997. Water salinization and shorebirds: Emerging issues. Int. Wader Studies 9:45–54.

Shuford, W. D., Page, G. W., Evens, J. G., and Stenzel, L. E. 1989. Seasonal abundance of waterbirds at Point Reyes: A coastal California perspective. W. Birds 20:137–265.

Shuford, W. D., Page, G. W., and Kjelmyr, J. E. 1998. Patterns and dynamics of shorebird use of California's Central Valley. Condor 100:227–244.

Shuford, W. D., Page, G. W., and Stenzel, L. E. 2002. Patterns of distribution and abundance of migratory shorebirds in the Intermountain West of the United States. W. Birds 33:134–174.

Shuford, W. D., and Ryan, T. P. 2000. Nesting populations of California and Ring-billed gulls in California: Recent surveys and historical status. W. Birds 31:133–164.

State of California Water Resources Control Board (SWRCB), Division of Water Rights. 1994a. Review of the Mono Basin water rights of the City of Los Angeles. Final environmental impact report. Jones and Stokes Assoc., 2600 V St., Suite 100, Sacramento, CA 95818-1914.

State (of California) Water Resources Control Board. 1994b. Mono Lake Basin Water Right Decision 1631. State Water Resources Control Board, Div. of Water Rights, P.O. Box 2000, Sacramento, CA 95810.

StatSoft. 1995. STATISTICA vol. III: Statistics II, 2nd ed. StatSoft, Inc., Tulsa, OK.

Stenzel, L. E., and Page, G. W. 1988. Results of the first comprehensive shorebird census of San Francisco and San Pablo Bays. Wader Study Group Bull. 54:43–48.

Stine, S. 1995. Historical and future waterfowl habitat at Mono Lake, CA. Unpubl. report to the Calif. State Lands Commission and the Calif. Dept. of Parks and Recreation (order from Scott Stine, 1450 Acton Crescent, Berkeley, CA 94702).

Swarth, C. W. 1983. Foraging ecology of Snowy Plovers and the distribution of their arthropod prey at Mono Lake, CA. M. S. thesis, Calif. State Univ., Hayward.

Vorster, P. 1985. A water balance forecast model for Mono Lake, California. M. A. thesis, Calif. State Univ., Hayward.

Warnock, N., Reed, J. M., and Oring, L. W. 1997. Synthesis: Shorebirds in the arid western Great Basin of North America. Int. Wader Studies 9:80–81.

Warnock, N., and Bishop, M. A. 1998. Spring stopover ecology of migrant Western Sandpipers. Condor 100:456–467.

Warnock, N., Haig, S. M., and Oring, L. W. 1998. Monitoring species richness and abundance of shorebirds in the western Great Basin. Condor 100:589–600.

Winkler, D. W., Weigen, C. P., Engstrom, F. B., and Burch, S. E. 1977. Ornithology, in An ecological study of Mono Lake, California (D. W. Winkler, ed.), pp. 88–113. Univ. Calif. Davis Inst. Ecol. Publ. 12.

Winter, J., and Manolis, T. 1978. Middle Pacific Coast region. The spring migration. Am. Birds 32:1049–1053.

Accepted 4 April 2002

COMPOSITION OF RAPTORS ON ESPÍRITU SANTO ISLAND, GULF OF CALIFORNIA, MEXICO

ROBERTO CARMONA, Universidad Autónoma de Baja California Sur, Departamento de Biología Marina, Apdo. Postal 19-B, La Paz, Baja California Sur, C.P. 23000, México

GORGONIO RUIZ-CAMPOS, Universidad Autónoma de Baja California, Facultad de Ciencias, Apdo. Postal 1653, Ensenada, Baja California, C.P. 22800, México (U.S. mailing address: PMB 064, P.O. Box 189003-064, Coronado, California 92178)

JOSÉ ALFREDO CASTILLO-GUERRERO and EFRÉN HERNÁNDEZ, Universidad Autónoma de Baja California Sur, Departamento de Biología Marina, Apdo. Postal 19-B, La Paz, Baja California Sur, C.P. 23000, México

ABSTRACT: We surveyed raptors on Espíritu Santo Island, Gulf of California, bimonthly from November 1998 to October 1999. Visual surveys averaged 64 hours per visit. We collected two Elf Owls by mist net. Of the ten species of raptors recorded, five are resident (Turkey Vulture, Osprey, Red-tailed Hawk, Great Horned Owl, and Elf Owl), two are common visitors (Peregrine Falcon and American Kestrel), and three are rare visitors (Northern Harrier, Harris' Hawk, and Golden Eagle). Four species were previously unrecorded on the island (Northern Harrier, Harris' Hawk, Golden Eagle, and Elf Owl). Of the ten species, three are protected by the Mexican government.

The avifauna of the Baja California peninsula and the Gulf of California has attracted attention of ornithologists since the early 20th century. A number of investigators have documented the peninsular (e.g., Brewster 1902, Grinnell 1928, Wilbur 1987, Erickson and Howell 2001) and insular avifauna (Cody 1983); however, these expeditions have been limited in sampling time and intensity.

The importance of the Gulf of California to aquatic birds is well known (e.g., Anderson 1983, Carmona et al. 1994, Massey and Palacios 1994), but very few studies have focused on land birds of the islands of the southern gulf. Two studies (Emlen 1979, Cody 1983) found that among the islands in the Gulf of California Espíritu Santo supports the second greatest number of insular landbird species, after San José Island. Detailed information on the spatial and temporal composition of land birds on islands of the Gulf of California is needed to identify potential conservation issues.

Raptors play important roles in food webs of insular ecosystems and can be excellent indicators of habitat quality (Bildstein et al. 1998). It was for this reason that we chose to evaluate and monitor this functional group on Espíritu Santo Island.

STUDY AREA

Espíritu Santo archipelago is formed by two large islands (Partida and Espíritu Santo) and four small islands (Los Islotes, La Ballena, El Gallo and La Gallina) (Figure 1). Our study site, Espíritu Santo Island, is located at the mouth of La Paz Bay, Baja California Sur, the largest protected water body

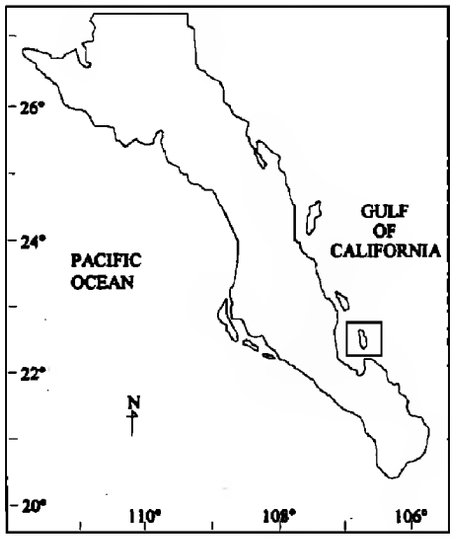


Figure 1. Location of Espíritu Santo Island in the Gulf of California.

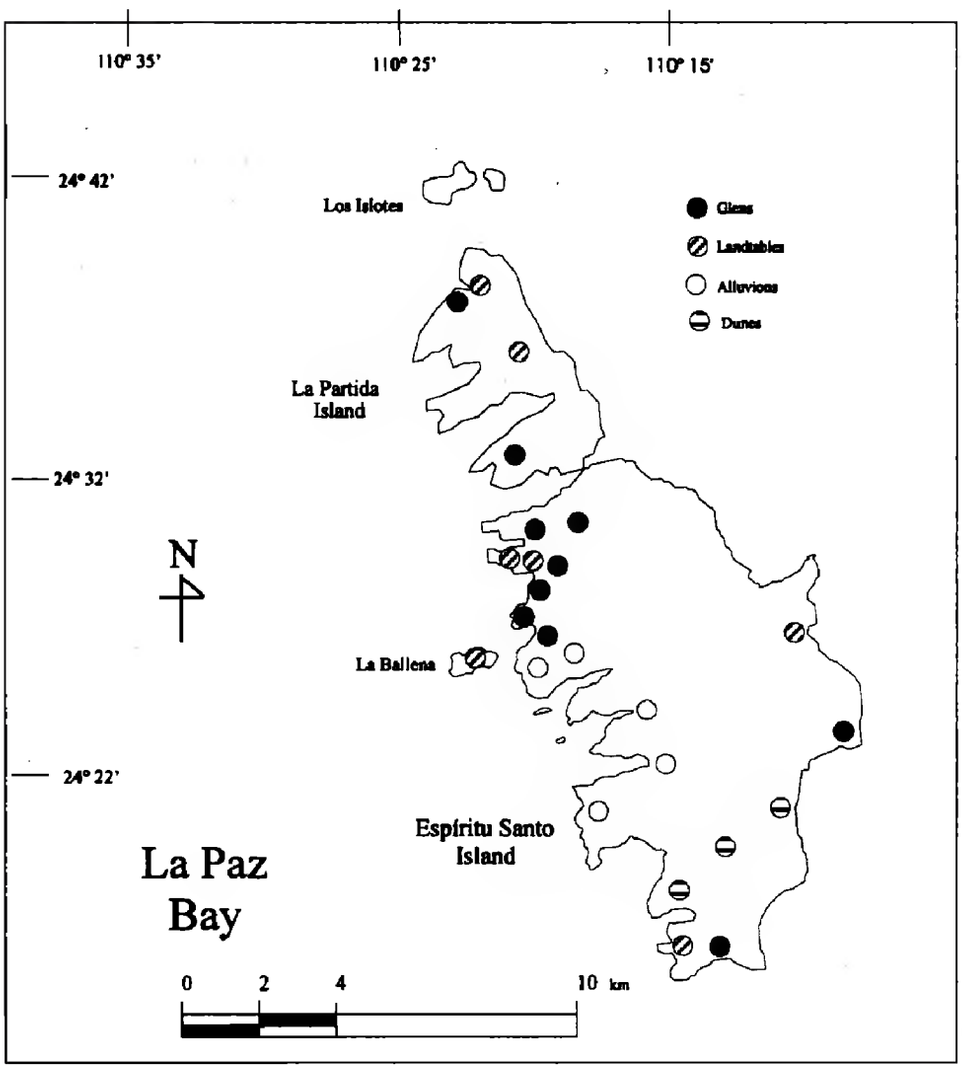


Figure 2. Location and habitat of survey sites on Espíritu Santo Island.

on the west side of the Gulf of California. The climate of La Paz Bay region is semi-arid, with an annual average rainfall of 200 mm, evaporation of 210 mm, and temperature of 24° C (García and Mosiño 1969). The rainy season extends from July to September and is directly related to the hurricane period (García and Mosiño 1969). Winds are predominantly from the northwest from November to March, from the southeast from April to October (García and Mosiño 1969).

Espíritu Santo Island is about 19 km long and 5.5 km wide. On its protected western section, where several ephemeral creeks meet, there are sandy beaches. The exposed eastern coast is characterized by high cliffs. Emlen (1979) recognized four environmental units on the island: (1) dunes, located on flats at low elevations; (2) glens, which are small, densely vegetated ephemeral creeks with bottoms of gravel and rocks transported by runoff; (3) landtables, which are flat uplands of hard substrate, relatively poor in vegetation; and (4) alluvions, which are sedimentary deposits formed in the mouths of glens.

METHODS

We systematically sampled six to ten sites on the island bimonthly between November 1998 and October 1999, covering various habitats (Figure 2). A total of 25 sites were sampled during the study period. Two observer teams of three persons each surveyed 0600 to 1000 and from 1600 to 2000, completing an average of 64 hours of observation per four-day sampling period. The teams used binoculars (12 × 50) and telescopes (20–50 × 50). In addition, we used two mist nets to collect nocturnal species during two nights per visit.

SPECIES ACCOUNTS

Turkey Vulture (*Cathartes aura*)

A common resident of lowlands along the peninsula and on adjacent islands. In summer, this species congregates in the northern mountains. There are several nesting records from the cape district, particularly near the town of Miraflores (Wilbur 1987). On Espíritu Santo Island, this scavenger was the only species found to be abundant during the study period, ranging from 28 individuals detected in November to 45 in August (Table 1). Several juveniles (one photographed) were seen in October and November, and local residents reported Turkey Vulture nests on the high parts of the island. The presence of this species was previously reported for the island by Banks (1963a), Cody (1983), and Rodríguez-Estrella et al. (1995).

Osprey (*Pandion haliaetus*)

A common breeding resident of the peninsula and adjacent islands (Wilbur 1987, Howell and Webb 1995), including Espíritu Santo (Banks 1963a). We saw this species commonly on the island (one to three individuals per visit), except in June (Table 1). A pair was observed in aerial courtship at the north

Table 1 Counts of Raptors on Espíritu Santo Island, Bahía de La Paz, November 1998–October 1999

Species	Nov	Jan	Mar	Jun	Aug	Oct
Turkey Vulture	28	35	30	41	45	32
Osprey	3	3	1		2	3
Northern Harrier						1
Red-tailed Hawk	7[a]	10[b]	4	2	3	4
Harris' Hawk					1	
Golden Eagle	1[c]					
Peregrine Falcon	4	1	3			
American Kestrel	2	5	2			5
Great Horned Owl		2			1	
Elf Owl					2	
Number of species	6	6	5	2	6	5

[a]Four adults, three juveniles.

[b]Eight adults, two juveniles.

[c]Same individual observed two consecutive days.

end of the island (11 November 1998), and an active nest was detected in March. Carmona et al. (1994) observed three nests of this species on the island in 1984, 22 in 1986. From that time, the number of nests has decreased, to six in 1988 and one in 1999 (Carmona et al. 1994; this study). Human disturbance and fluctuations in food availability may have caused reduction of reproductive success of this species.

Northern Harrier (*Circus cyaneus*)

The Northern Harrier is an uncommon resident in northwestern Baja California, with winter records in the southern part of the peninsula (Wilbur 1987, Howell and Webb 1995). Recently, Castillo and Carmona (2001) recorded the Northern Harrier on the east coast of the Baja California peninsula. On Espíritu Santo Island we noted (and photographed) this hawk only once, in flight on an alluvion in front of Islote El Gallo on 19 October 1999 (Table 1). Our record constitutes the first report of this species on any island of the lower Gulf of California.

Red-tailed Hawk (*Buteo jamaicensis*)

The Red-tailed Hawk is a common resident throughout the peninsula and its adjacent islands (A.O.U. 1983, Wilbur 1987, Howell and Webb 1995), recorded previously on Espíritu Santo Island by Cody (1983). Local populations are increased in winter by the arrival of migrants (Wilbur 1987). We found the Red-tailed Hawk to be a common permanent resident of the island, two to ten individuals detected per visit (Table 1). Although we did not find direct evidence of local nesting, a juvenile on 14 November 1998 and adults throughout the year suggest reproduction in the study area (Table 1).

This hawk was frequently seen hunting during our field surveys. Other occupied islands in the Gulf of California include Carmen (Gaviño et al. 1984) and Cerralvo (Banks 1963b).

Harris' Hawk (*Parabuteo unicinctus*)

Considered as specially protected by the Mexican government (N.O.M. 2002). This hawk inhabits savannas and semiopen areas, especially in or near riparian vegetation. It is a common resident of the central and southern peninsula (Wilbur 1987, Howell and Webb 1995). An adult was hunting an adult Purple Martin (*Progne subis*) in flight on the eastern part of Ballena Island on 21 August 1999 (Table I). The hawk attacked the martin three times, without success. The only previous record of Harris' Hawk for islands of the Gulf of California was from San José Island, on 23 May 1928 (Wilbur 1987).

Golden Eagle (*Aquila chrysaetos*)

The Mexican government considers this eagle threatened (N.O.M. 2002). On the peninsula, it is a sparse resident north of latitude 30° 30′ N (Wilbur 1987, A.O.U. 1983,) with winter records south through Baja California Sur (Howell and Webb 1995). During our study, a juvenile was seen twice on 11 and 13 November 1998 (Table 1). On both occasions, a pair of Peregrine Falcons assaulted the eagle. The last record of the Golden Eagle for islands of the Gulf of California, and the only known record south of 26° N (Wilbur 1987), was of a juvenile observed on 26 October 1961 on Cerralvo Island (Banks, 1963b).

Peregrine Falcon (*Falco peregrinus*).

This falcon, considered as specially protected by the Mexican government (N.O.M. 2002), is an uncommon resident throughout the peninsula and on islands of the Gulf of California (Howell and Webb 1995). We found it to be common winter visitor to Espíritu Santo Island, with one to four individuals noted per day from November to March (Table 1). We observed it regularly near the coast, hunting storm-petrels (*Oceanodroma* spp.) and Bonaparte's Gulls (*Larus philadelphia*). Banks (1969) reported a breeding pair at Espíritu Santo Island in 1962.

American Kestrel (*Falco sparverius*)

This falcon is a fairly common to uncommon resident on the peninsula and adjacent islands (Howell and Webb 1995); a concentration of 182 along 217 km of highway between La Paz and Cabo San Lucas 12 December 1983 (S. N. G. Howell pers. comm.) suggests a winter influx to the cape district (cf. Grinnell 1928). We found the American Kestrel to be a common visitor to Espíritu Santo Island (Table 1), with one to five individuals per day during four of the six survey periods. Previous insular records for the American Kestrel in the Gulf of California are from Cerralvo Island (Banks 1963b) as well as Espíritu Santo (Cody 1983). This species was apparently absent from Espíritu Santo Island from June to August, when prey abundance was low (Carmona 2000).

Great Horned Owl (*Bubo virginianus*)

The Great Horned Owl is a common resident of the peninsula, using a wide variety of habitats (Grinnell 1928, Wilbur 1987, Howell and Webb 1995). On 27 January 1999, we observed one resting in a hollow that is apparently a regular roost; another individual was found on 3 August 1999 (Table 1), perching on a rock in a glen. Cody (1983) previously reported this species from Espíritu Santo Island. Because this nocturnal species may be overlooked, we consider it a resident on the island.

Elf Owl (*Micrathene whitneyi*)

On the peninsula a population of this owl is resident in the cape district (Grinnell 1928, Wilbur 1987, Howell and Webb 1995). In the Gulf of California, the Elf Owl has been found only on Tiburón Island in the northern gulf (Cody 1983). We captured two Elf Owls on 5 August 1999 within dune vegetation in the southern part of the island (Table 1). These are the first specimens for any island of the Gulf of California. Specimens are deposited in the bird collections of the UABC (catalog number 1033) and UABCS. A previous lack of nocturnal sampling may account for the absence of records of this species and possibly others at Espíritu Santo Island.

DISCUSSION

Four species (Northern Harrier, Harris' Hawk, Golden Eagle, and Elf Owl) reported here were previously unreported on Espíritu Santo Island. The number of raptor species now recorded from Espíritu Santo Island exceeds the totals known from nearby islands such as San José (with a larger area; Cody 1983) and Cerralvo (Banks 1963b), which have six and eight species, respectively. Of the islands of the Gulf of California, only the much larger Tiburón Island has been found to support an equal richness of raptor species (Cody 1983). Since no other island in the Gulf of California has been sampled for raptors throughout the year, however, such a comparison should be interpreted with caution.

The number of species noted on the island per survey was relatively constant (five or six species) except in June. The highest species numbers (in August and November) coincided with the arrival of migrants and the fledgling of local young, while lowest numbers (June) are probably associated with a shortage of prey during the drought season (Carmona 2000). It is probable that most individual raptors at Espíritu Santo Island move occasionally to the peninsular mainland in search of prey and other resources (Carmona 2000).

A current problem on the Espíritu Santo Island is the presence of exotic fauna, especially cats and goats. Cats and raptors are in direct competition for prey, while goats cause modifications in the vegetation that may decrease the availability of prey for the raptors.

Given the high conservation priority that the Mexican government (N.O.M., 2002) places on raptors, continued monitoring of this group is needed in order to determine the population dynamics of the species and their relationships with anthropogenic effects. Such effects include fishing, ecotourism, and exotic animals.

ACKNOWLEDGMENTS

This work was financed by CONABIO, Mexico (project FB611/R196/98). Our sincere thanks to F. Betancourt, R. León Lucero, and E. Winkler for their great support in supplying transportation by boat to and from the island. Thanks also to all "the band" collaborating during the field surveys, pardon any omission: G. Brabata, A. Cuéllar, E. Lozano, A. Jiménez, M. Zamora, A. González, V. Quintero, M. Nájera, L. Gómez, O. Angúlo, P. Castro and D. Galindo. Thanks to R. Carmona-Zárate for the record of Harris' Hawk. H. Reyes, R. C. Banks, S. R. Wilbur, R. A. Hamilton, and C. Henny made useful comments on the manuscript. Finally, we are especially grateful to Marco for his invaluable hospitality.

LITERATURE CITED

Anderson, D. W. 1983. The seabirds, in Island Biogeography in the Sea of Cortéz (T. J. Case and M. L. Cody, eds.), pp. 246–264. Univ. of Calif. Press, Berkeley.

Banks, R.C. 1963a. Birds of the Belvedere expedition to the Gulf of California. Trans. San Diego Soc. Nat. Hist. 13:49–60.

Banks, R. C. 1963b. Birds of Cerralvo Island, Baja California. Condor 65:300–312.

Banks, R. C. 1969. The Peregrine Falcon in Baja California and the Gulf of California, in Peregrine Falcon Populations: Their Biology and Decline (J. J. Hickey, ed.), pp. 81–91. Univ. of Wisc. Press, Madison.

Bildstein, K. L., Schelsky, W., Zalles, J., and Ellis, S. 1998. Conservation status of tropical raptors. J. Raptor Res. 32:3–18.

Brewster, W. 1902. Birds of the cape region of Lower California. Bull. Mus. Comp. Zool. 41:1–241.

Carmona, R. 2000. Riqueza específica de aves terrestres en Isla Espíritu Santo, Baja California Sur, México. Insulario 11–12:2–12.

Carmona, R., Guzmán, J., Ramírez, S., and Fernández, G. 1994. Breeding waterbirds of La Paz Bay, Baja California Sur, México. W. Birds 25:151–157.

Castillo-Guerrero, J. A., and Carmona, R. In press. Distribución de aves acuáticas y rapaces en un embalse dulceacuícola artificial de Baja California Sur, México. Biol. Trop. 49:1131–1142.

Cody, M. 1983. The land birds, in Island Biogeography in the Sea of Cortez (T. J. Case and M. L. Cody, eds.), pp. 210–245. Univ. of Calif. Press., Berkeley.

Emlen, J. T. 1979. Land bird densities on Baja California islands. Auk 96:152–167.

Erickson, R. A., and Howell, S. N. G., eds. 2001. Birds of the Baja California Peninsula: Status, distribution, and taxonomy. Am. Birding Assoc. Monogr. Field Ornithol. 3.

García, E., and Mociño, P. A. 1969. Los climas de Baja California. Inst. Geofís. Univ. Nacl. Autónoma Mex. Memorias, 1966–1967, pp. 29–56.

Gaviño, G., Aguilar, F., and García, L. C. 1984. Abundancia relativa, reproducción y actividad diurna de aves terrestres en la Isla Carmen, Baja California Sur, México. An. Inst. Biol., Univ. Nacl. Autónona Méx. 55, Ser. Zool. 2:263–284.

Grinnell, J. 1928. A distributional summation of the ornithology of Lower California. Univ. Calif. Publ. Zool. 32:1–300.

Howell, S. N. G., and Webb, S. 1995. A Guide to the Birds of Mexico and Northern Central America. Oxford Univ. Press, Oxford, England.

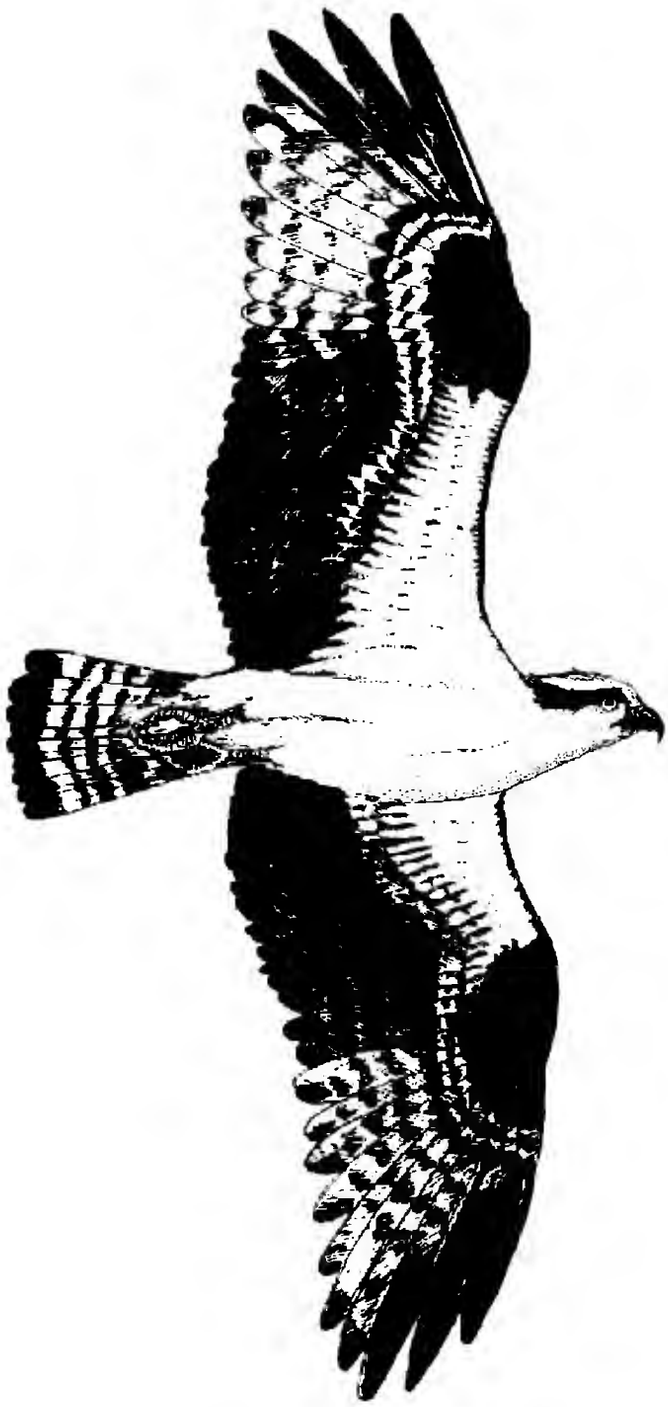
Massey, B. W., and Palacios, E. 1994. Avifauna of the wetlands of Baja California, México: Current status. Studies Avian Biol. 15:45–57.

N.O.M. [Norma Oficial Mexicana]. 2002. Norma Oficial Mexicana NOM-059-ECOL-2001, Protección ambiental—especies nativas de México de flora y fauna silvestres— categorías de riesgo y especificaciones para su inclusión, exclusión o cambio—lista de especies en riesgo. Diario Oficial de la Federación, México, D. F., 6 mayo 2002.

Rodríguez-Estrella, R., Donázar, J. A., and Hiraldo, F. 1995. Yellow-footed Gulls attack Turkey Vultures on Isla Espíritu Santo, Baja California, Mexico. Colonial Waterbirds 18:100–101.

Wilbur, S. R. 1987. Birds of Baja California. Univ. of Calif. Press, Berkeley.

Accepted 13 August 2001



Osprey *Sketch by George C. West*

NOTEWORTHY WATERBIRD RECORDS IN THE DELTA OF THE RÍO COLORADO, MEXICO, 2002

ERIC MELLINK, JOSÉ ALFREDO CASTILLO-GUERRERO, and AIMEÉ de la CERDA, Centro de Investigación Científica y de Educación Superior de Ensenada, B. C., Apartado Postal 2732, Ensenada, Baja California, México (U.S. mailing address: CICESE, P. O. Box 434844, San Diego, California 92143-4844)

ABSTRACT: Surveys of the Río Colorado delta in summer 2002 revealed abandonment of one large heronry but the existence of another large and several small, inconspicous heronries previously nonexistent or undetected. Most notable among these mixed-species colonies were two nests of the Tricolored Heron and two fledglings of the Reddish Egret, representing considerable northward extensions of these species' breeding ranges.

The waterbirds of the Mexican portion of the Río Colorado delta are relatively well known (see Patten et al. 2001), especially those breeding on Isla Montague and at the Cerro Prieto evaporation ponds (Peresbarbosa and Mellink 2001, and references therein; Molina and Garrett 2001). During the 2002 breeding season, however, while collecting samples for a study of trophic relationships in this region, we made some noteworthy observations of breeding waterbirds and of some nonbreeding species for which few records exist.

We visited the delta region 4–6 March, 15–19 April, 29 April–3 May, 2–5 June, 12 June, 24–26 July, 30–31 July, and 8 September. Additionally, on 24 April, using a Beechcraft twin-engine airplane to fly over the delta's major watercourses (Río Hardy, Río Colorado, Canal Pescaderos) and the Ciénega de Santa Clara, we conducted an aerial survey for rookeries. On 30 July 2002, we inspected the large heronry on an islet in the middle of an agricultural drain reported by Mora (1989, 1991, 1992, 1997) near Colonia Venustiano Carranza, hereafter called the "Carranza heronry." The drain channel beneath the heronry was dry, and the shrubby tamarisks (*Tamarix ramosissima*) on which the herons had nested were charred from a recent fire. There were no signs of herons at this place, nor in nearby large patches of tamarisk that seemed suitable as breeding habitat. A farmer (Roberto Viridiola) indicated that the heronry was active as of 2000.

SPECIES ACCOUNTS

Breeders

Great Blue Heron (*Ardea herodias*). This species is considered a common breeding resident (Patten et al. 2001, Wilbur 1987), with nesting in northeastern Baja California known only from Cerro Prieto and Isla Montague. A large Athel Tamarisk (*Tamarix aphylla*) near the Río Hardy (32° 12.601′ N, 115° 15.511′ W) held five recently abandoned nests, below which were remains of a small and a half-grown Great Blue Heron.

Great Egret (*Egretta alba*). This species is considered a common local breeding resident (Patten et al. 2001), with nesting known from the Cerro Prieto evaporation ponds (Molina and Garret 2001) and the former Carranza heronry (Mora 1992, 1997). In 2002 we found this species breeding at three additional locations. On 29

April several Great Egrets were observed in the top of a large Fremont Cottonwood (*Populus fremontii*) near Ejido Cucapá Indígena (32° 17.347′ N, 115° 18.457′ W), with one pair building a nest. On 24 July, one of eight nests in this cottonwood was occupied by a Great Egret. Four nests were of Snowy Egrets (*E. thula*), and three were of unknown species.

We found the second colony on 26 July in the canopy of several large Fremont Cottonwoods along the Río Hardy, next to a semi-abandoned farm house in Colonia Muñoz (32° 12.375′ N, 115° 16.148′ W). It included about 20 nests of the Great Egret, some with small to large chicks. Several adult Great Egrets were observed feeding in the nearby river.

The third colony, of 10 nests in large Fremont Cottonwoods, was found 26 July near Ejido Oaxaca (32° 19.418′ N, 115° 10.834′ W). These birds were adjacent to a larger mixed heronry (hereafter called the "Oaxaca heronry") composed of Snowy Egrets, Tricolored Herons (*E. tricolor*), Cattle Egrets (*Bubulcus ibis*), and Black-crowned Night-Herons (*Nycticorax nycticorax*). The colony contained chicks of various sizes. On 31 July, several large eucalyptus trees (*Eucalyptus* spp.) by an abandoned farmhouse 2.8 km from this heronry (32° 20.468′ N, 115° 09.477′ W) were used as a roost by Great Egrets as well as Black-crowned Night-Herons. In addition to guano, nuptial plumes of this egret littered the ground, suggesting it was a post-breeding molting roost. At this time, very few Great Egrets remained at the Oaxaca heronry (compared with the number of nests), and it seems likely that birds from this colony were the occupants of this roost, as there was no other Great Egret colony nearby. On 8 September there were no Great Egrets at the Oaxaca heronry.

Snowy Egret (*Egretta thula*). This common local resident (Patten et al. 2001) nests on Isla Montague and at Cerro Prieto and nested in the defunct Carranza heronry (Mora 1992, 1998). On 24 July we recorded at least four Snowy Egret nests with large young near Ejido Cucapá Indígena, and on 26 July we observed 15 to 20 adults incubating at the Oaxaca heronry, with one nest containing two young. On 8 September, only three adults and one juvenile remained at the Oaxaca heronry.

Tricolored Heron (*Egretta tricolor*). On 26 and 31 July, we found two pairs nesting within the Oaxaca heronry. The nests were hidden deep in tamarisk and contained three eggs and at least two chicks, respectively. This species had not been recorded breeding in the area before, although it was known as a summer vagrant (Patten et al. 2001). There is, however, a record of its probably breeding at the Salton Sea (Howell and Pyle 1997). The closest known regular breeding localities are in southern Sonora (Russell and Monson 1998) and central Baja California (Wilbur 1987). The species was absent from this colony on 8 September.

Reddish Egret (*Egretta rufescens*). The behavior of birds at Estero del Chayo, Isla Montague, on 4 and 12 June suggested breeding, but we could not locate a nest. On 4 June an adult appeared to sit on a nest (the topography precluded us from assessing this definitively), but we later confirmed only a Snowy Egret nest there. On 25 July we found two adult Reddish Egrets with two fairly large young in this area. This observation suggests that Bancroft (1927:42) might have been correct when stating "I have good reason to believe it nests in the Delta region." In recent years the species has not been recorded nesting in the delta of the Río Colorado (Patten et al. 2001, Peresbarbosa and Mellink 2001), and the closest regular breeding locality is Isla San Luis (Bancroft 1927, van Rossem 1926; E. Mellink field data), 190 km south of Isla Montague. Two to three pairs of nesting Reddish Egrets at Isla Todos Santos, at roughly the same latitude as Isla Montague but on the Pacific side of the peninsula, from 1999 to 2002 (Palacios and Mellink 2000, Erickson et al. in press) suggest that the species may be expanding its range northward on both coasts of Baja California. In addition to our Isla Montague observation, we observed an adult Reddish Egret feeding in the Río Hardy (32° 07.190′ N, 115° 14.461′ W) on 26 July.

Cattle Egret (*Bubulcus ibis*). Patten et al. (2001) considered this species a common breeding resident that colonized northeastern Baja California in the mid-1960s. It had been breeding at the Carranza heronry since 1972 (Mora 1989). On 26 July the Oaxaca heronry included 500–1000 pairs of Cattle Egrets. The nests, in tamarisk, contained from eggs to large chicks. Several Turkey Vultures (*Cathartes aura*) perched on nearby Fremont Cottonwoods presumably feasted on the carcasses of many young birds that fell out of the nests (although pigs were slaughtered at a nearby ranch, potentially providing additional food for the vultures). On 8 September only a few nests, some with small chicks, remained active. At this time, many juveniles and some adults were at the colony site.

Black-crowned Night-Heron (*Nycticorax nycticorax*). This species is a common resident of Valle de Mexicali, with nesting known only from Isla Montague (Wilbur 1987, Patten et al. 2001). On 16 and 29 April and 1 May, we saw Black-crowned Night-Herons fly from two nests high in a 10-m tamarisk located adjacent to Canal Pescaderos (32° 11.423′ N, 115° 13.154′ W). We found remains of several crayfish (*Procambarus* sp.) on the ground below, and on 26 July we climbed the tree and examined the four nests at the top. Three looked as if they had been abandoned for some time, but the fourth, although empty, was in good shape. The only individual we saw on this date flushed from somewhere near that nest.

On 13 and 14 June we observed two pairs near Cerro Prieto's main heronries in pond V3 on the northeastern side of the geothermal complex (Molina and Garrett 2001). A rudimentary nest of no more than a dozen sticks was present in an Iodine Bush (*Allenrolfea occidentalis*); on 24 July this nest contained a half-grown chick.

Finally, about 10 nests were occupied by adult Black-crowned Night-Herons at the Oaxaca heronry on 26 and 31 July. Most were in tamarisk, but at least one was in a Honey Mesquite (*Prosopis glandulosa*). One nest contained three eggs, and there was a dead chick of this species in the canopy of a Date Palm (*Phoenix dactylifera*). On 8 September we failed to find the species at this site.

American Avocet (*Recurvirostra americana*). Incubating adults of this species had been observed in Cerro Prieto in 2000 and 2001 (Molina and Garrett 2001), and on 30 April we found a nest with four eggs. On 13 June two nests had eggs, while two other nests with incubating adults could not be examined.

Caspian Tern (*Sterna caspia*). This tern is fairly common year round in northeastern Baja California, with nesting confirmed only at Cerro Prieto (Molina and Garrett 2001, Patten et al. 2001). On 4 May 1994 several individuals exhibited nest-defense behavior on a chernier (subfossil shell deposit) by the lighthouse on Isla Montague (Mellink and E. Palacios pers. obs.), but it was suspected that these birds' nests had been flushed away by high tides the day before. On 12 June 2002 we counted 83 nests on Isla Montague, 33 with one egg, 46 with two eggs, three with one egg and one pseudoegg, and one with one chick. On 26 July, some Caspian Terns were still on eggs, but there were also several chicks, small and large. The colony was at the end of a large chernier 3 km northwest of the lighthouse (31° 41.797′ N, 114° 44.810′ W). There was a Royal Tern (*Sterna maxima*) colony near the Caspian Tern colony, and Black Skimmers (*Rynchops niger*) nested in large numbers throughout the area. We also observed a few nests of the Gull-billed Tern (*Sterna nilotica*) and one of the Laughing Gull (*Larus atricilla*) near the Caspian Tern nests.

Nonbreeders

Wood Stork (*Mycteria americana*). The only recent records of this species in the area are of up to ten at Campo Thy-Thy 27–28 August 1994 and nine at Terrenos Indios 7 September 1995 (Ruiz-Campos and Rodríguez-Meraz 1997). On 30 July we recorded 36 individuals, mostly second-year birds, but also three juveniles and at least

one adult, in a tributary to the Río Hardy (32° 13.221′ N, 114° 12.499′ W). This count is notable because such numbers have not been equaled at the Salton Sea since the mid 1990s (Patten et al. in press).

Mallard (*Anas platyrhynchos*). This is an uncommon winter visitor with only one previous summer record (Patten et al. 2001). On 31 July, four females were in Canal Pescaderos near El Caimán (32° 12.462′ N, 115° 12.590′ W).

DISCUSSION

The observations we made during 2002, in addition to providing new information on the species recorded, point out several issues. Contrary to our expectation, heronries were scarce in the Mexican portion of the Río Colorado delta. Those we report on here were very inconspicuous, and there is a good chance that some small heronries remained undetected. Thus, in addition to the large heronries already known at Cerro Prieto and Isla Montague, small heronries scattered throughout the delta may also contribute significantly to conservation of various native species in the area. The stability or volatility of these small colonies from year to year remains unknown.

The forming of the large heronry near Colonia Carranza in 1972 (Mora 1989), and its disappearance in 2000 (this work), are a reminder that heronries are dynamic and subject to catastrophes. The fate of the birds that composed it is unknown and cannot be assessed. These birds did not merely move to the Oaxaca heronry, as local residents affirmed that this colony has existed for many years (although not earlier than 1988; Mora 1991).

Our records of nesting Caspian Terns, Reddish Egrets, and Tricolored Herons also reflect the dynamism of waterbird colonies. These cases may be different, though, as Caspian Terns seem to nest on Isla Montague during certain years, but the ardeids might represent range expansions (if they remain breeding in the area).

Clearly, knowledge of the waterbirds in this region is far from complete, and further surveys are needed. This is especially true for the eastern section of the delta, which has been particularly neglected by ornithologists. Exhaustive ground surveying and interviews with local people seem to be superior to aerial surveys for detecting heronries in the Río Colorado Delta because the small size and inconspicuousness of many colonies preclude their detection from the air (the large Oaxaca heronry was outside the track of our flight). In addition to a one-time survey, monitoring of the colonies would provide data for understanding the dynamics of waterbird colonies in this area and would increase our ability to develop appropriate conservation schemes.

ACKNOWLEDGMENTS

Gary Huxel, Drew Talley, and Sharon Herzka assisted during field work. James U. Lemke (Aerolift, Inc.) kindly supported us with the aerial survey over the region. Enrique Moreno, Mario Mora, and Mauricio Pérez provided logistical support throughout our visits to Isla Montague, and Ernesto Nieblas and Ricardo Somoza transported us to Isla Montague on 26 July. Roberto Viridiola, Alfredo Lepe, and Juan Quintero provided useful information. Michael A. Patten and Robert A. Hamilton provided

great editorial and scientific support, and they and Kimball L. Garrett, Steve N. G. Howell, and Richard A. Erickson critically reviewed a putative record (discarded). Philip Unitt pointed out important literature. To all of them, our deepest appreciation. Observations were made while carrying out field work for a UC Mexus-sponsored project. We were kindly allowed to use the field stations of the Reserva de la Biósfera del Alto Golfo de California y Delta del Río Colorado in Golfo de Santa Clara and Ejido Luis Encinas Johnson.

LITERATURE CITED

Bancroft, G. 1927. Breeding birds of Scammon's Lagoon, Lower California. Condor 29:29–57.

Erickson, R. A., Patten, M. A., Palacios, E., and Carmona, R. in press. Baja California Peninsula region. N. Am. Birds.

Howell, S. N. G., and Pyle, P. 1990. Additional notes on birds in Baja California. Aves Mexicanas 2 (90-1):6–7.

Howell, S. N. G., and Pyle, P. 1997. Twentieth report of the California Bird Records Committee: 1994 records. W. Birds 28:117–141.

Howell, S. N. G., and Webb, S. 1992. Noteworthy bird observations from Baja California, Mexico. W. Birds 23:153–163.

Molina, K. C., and Garrett, K. L. 2001. The breeding birds of the Cerro Prieto geothermal ponds, Mexicali Valley, Baja California, in Birds of Baja California: Status, distribution, and taxonomy (R. A. Erickson and S. N. G. Howell, eds.), pp. 23–28. Am. Birding Assoc. Monogr. Field Ornithol. 3.

Mora, M. A. 1989. Predation by a Brown Pelican at a mixed-species heronry. Condor 91:742–743.

Mora, M. A. 1991. Organochlorines and breeding success in Cattle Egrets from the Mexicali Valley, Baja California, Mexico. Colonial Waterbirds 14:127–132.

Mora, M. A. 1992. Habitat use by foraging Cattle Egrets in the Mexicali Valley, Baja California. Wilson Bull. 104:142–148.

Mora, M. A. 1997. Feeding flights of Cattle Egrets nesting in an agricultural ecosystem. Southw. Nat. 42:52–58.

Palacios, E., and Mellink, E. 2000. Nesting waterbirds on islas San Martín and Todos Santos, Baja California. W. Birds 31:184–189.

Patten, M. A., Mellink, E., Gómez de Silva, H., and Wurster, T. E. 2001. Status and taxonomy of the Colorado Desert avifauna of Baja California, in Birds of Baja California: Status, distribution, and taxonomy (R. A. Erickson and S. N. G. Howell, eds.), pp. 29–63. Am. Birding Assoc. Monogr. Field Ornithol. 3.

Peresbarbosa-Rojas, E., and Mellink, E. 2001. Nesting waterbirds of Isla Montague, northern Gulf of California, México: Loss of eggs due to predation and flooding, 1993–1994. Waterbirds 24:265–271.

Ruiz-Campos, G., and Rodríguez-Meraz, M. 1997. Composición taxonómica y ecológica de la avifauna del los ríos El Mayor y Hardy, y áreas adyacentes, en el Valle de Mexicali, Baja California, México. Anal. Inst. Biol. Mex. 68:291–315.

Russell, S. M., and Monson, G. 1998. Birds of Sonora. Univ. Ariz. Press, Tucson.

Van Rossem, A. J. 1926. The Lower California Reddish Egret. Condor 28:246.

Wilbur, S. R. 1987. Birds of Baja California. Univ. of Calif. Press., Berkeley.

Accepted 18 November 2002

NESTING BIRDS OF FARALLÓN DE SAN IGNACIO, SINALOA, MEXICO

MARCO ANTONIO GONZÁLEZ-BERNAL, Universidad Autónoma de Sinaloa, Ciudad Universitaria, Culiacán, Sinaloa, México

ERIC MELLINK, Centro de Investigación Científica y de Educación Superior de Ensenada, B. C., Apartado Postal 2732, Ensenada, Baja California, México (U.S. mailing address: CICESE, P. O. Box 434844, San Diego, California 92143-4844)

JOSÉ ROBERTO FONG-MENDOZA, Universidad Autónoma de Sinaloa, Ciudad Universitaria, Culiacán, Sinaloa, México

ABSTRACT: From 1999 to 2001 we made the first thorough bird surveys of Farallón de San Ignacio, an islet off Topolobampo, Sinaloa. The islet hosts 100-200 nesting pairs of the Red-tailed Tropicbird, about 1200 of the Brown Booby, 1400-1650 of the Blue-footed Booby, and about 1000 of Heermann's Gull. The Double-crested Cormorant and Yellow-footed Gull nest irregularly in small numbers.

Farallón de San Ignacio (25° 26′ N, 109° 22′ W) is a small islet in the Gulf of California located 27 km off the coast from Topolobampo, in northern Sinaloa (Figure 1). It is a barren steep-sided rock that rises 140 m above sea level. Its top is nearly flat and covers approximately 3.5–4 ha (B. F. Osorio-Taffal, unpubl. data, letter to E. Beltrán, dated 26 April 1944, deposited at the Instituto Mexicano de los Recursos Naturales Renovables, México, D.F.). The island has a few detached rocks to its north but is otherwise surrounded by deep water. Mean annual temperature of the region is 20° C, and mean annual precipitation is between 100 and 300 mm.

The island has not been thoroughly surveyed for its birds. Krull (in Hutchinson 1950) apparently visited the island in the late 19th century to evaluate the quality of its guano. Although some work was done there during the Allan Hancock Expeditions, it did not involve birds (Fraser 1943). Finally, in the spring of 1944 the island was briefly visited by Osorio-Taffal (1944, unpubl. data), but few data on the birds were obtained. Loye Miller (unpubl. data; 1939 typescript with Mellink) did not visit it on a 1939 cruise in the Gulf of California, nor was the island examined on a flight in the early 1940s (specific year not given) focused on the guano-producing islands in the Gulf of California (Vogt 1946).

We visited the island on the following dates: 13 April 1999 (EM), 18 April 2000 (EM), July 2000 (exact date lost, MAGB), January 2001 (exact date lost, MAGB), 5 February 2001 (MAGB), 6 March 2001 (MAGB, EM, JRF), and 21 May 2001 (MAGB, EM). On the first two dates Mellink approached the island from the north scanned the northern and eastern slopes with binoculars. Scanning of other slopes as well as landing was prevented by rough seas (except for a brief approach to a group of detached rocks). On the other visits we landed, examined the northern slope and the top, and circumnavigated the island. Visits were made by sailboat from La Paz, Baja California Sur (the first two visits) or by fiberglass motorized fishing skiffs chartered out of Topolobampo (all the others).

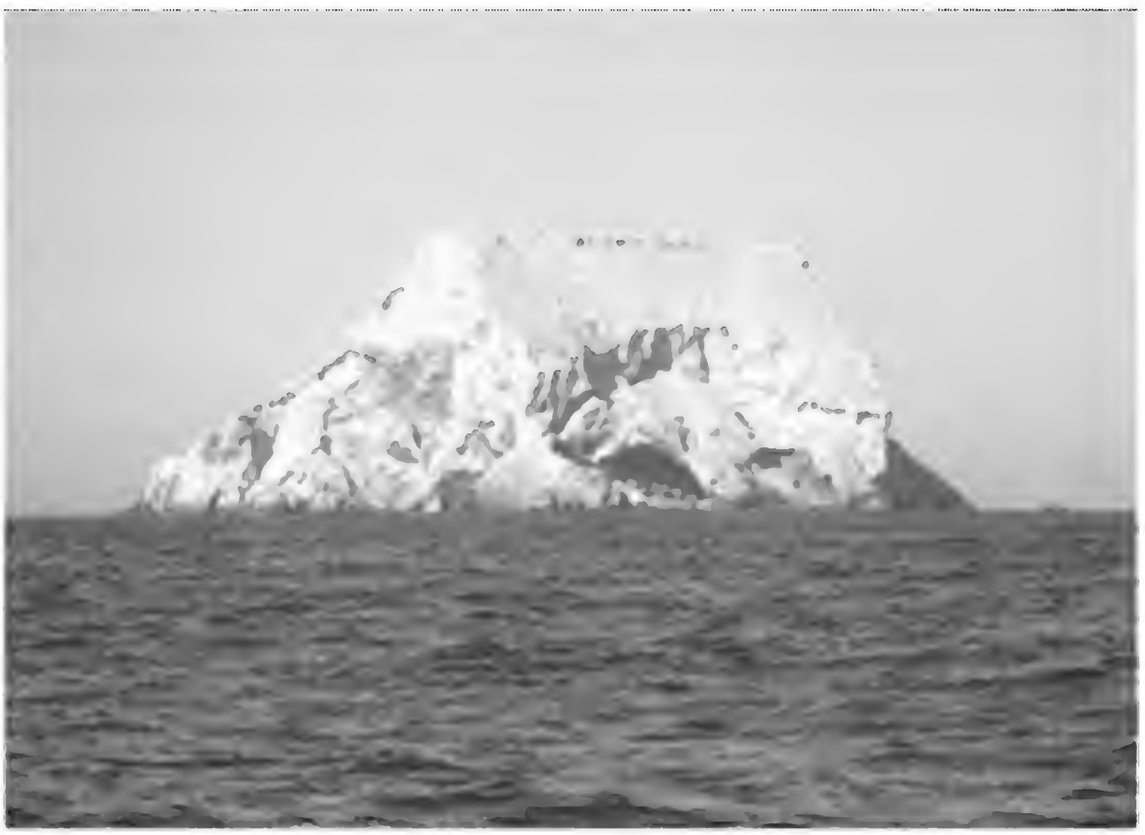


Figure 1. Farallón de San Ignacio, seen from the east.

Photo by M. A. González-Bernal

SPECIES ACCOUNTS

Red-billed Tropicbird (*Phaethon aethereus*). This species was a breeder on the island at the end of the 19th century (Krull in Hutchinson 1950), but Osorio-Taffal (1944, unpubl. data) failed to record it (although he did record the species from other islands). In February 2001 we estimated between 100 and 200 pairs nesting in crevices near the top of the island. By May 2001, most birds were absent, and only three of 50 marked nests were still active (they had chicks). Of 14 unmarked nests examined on this date, 13 held chicks and one an egg. In May 2001 we recorded 10 active nests, with eggs or chicks, and one pair in aerial courtship.

The importance of this island for Red-billed Tropicbirds has not been recognized previously. For example, the fifth edition of the A.O.U. checklist of North American birds (1957) indicated its probable nesting on this island, but the 7th edition of the checklist (1998) ignored it. Velarde and Anderson (1994) considered Isla San Pedro Mártir with its 150–250 pairs (Everett and Anderson 1991, Tershy and Breese 1997) the only significant colony of this species in the Gulf of California. The Farallón de San Ignacio colony represents an important increase in the known population of the Gulf of California.

Brown Booby (*Sula leucogaster*). This species is a common resident on the island (Krull in Hutchinson 1950, Nelson 1978). Our maximum tally was of about 1200 pairs nesting in March 2001, when most birds were at some stage of breeding, from courtship to the tending of chicks (a detailed count was not carried out at this time). At this time there were also many gray juveniles, suggesting that the breeding season at Farallón de San Ignacio could have begun early in 2001 (see Mellink 2000). This species reduced its breeding on this island in the summer, as elsewhere in the Gulf of

California (Mellink 2000), and there were none nesting in May 2001, but there was a nest with one egg in July 2000, and one with a small chick in October 2000.

Blue-footed Booby (*Sula nebouxii*). Farallón de San Ignacio is one of the important breeding islands for this species in the Gulf of California (Nelson 1978). Osorio-Tafall (unpubl. data) noted about 5000 boobies on the Farallón, mostly Blue-footed. Interestingly, Krull (in Hutchinson 1950) made no mention of this species, but it is not clear whether he visited the top of the island, to which Blue-footed Boobies are restricted. In February and March 2001 we found 1400 and 1650 nesting pairs; most were tending eggs, but there were at least five juveniles. One nest attended by a male contained only a pseudo-egg, consisting of an irregularly shaped rock measuring 136.8 × 48.1 × 41.9 mm (Mellink 2002b). Breeding was greatly reduced during the summer. In July 2000 we found one nest with an egg, another with a half-grown chick, and in May 2001 there were no active nests.

Double-crested Cormorant (*Phalacrocorax auritus*). Eighteen nests of this species were counted on the northern cliffs in February 2001. A month later most contained large chicks, but one nest had an egg and two recently hatched chicks. In May 2001 there were no Double-crested Cormorants on the island.

Heermann's Gull (*Larus heermanni*). On 18 April 2000, Mellink confirmed the presence of eggs in one Heermann's Gull nest, but bad weather precluded a landing to inspect 20 to 40 additional gulls that appeared to be on nests (Mellink 2001). They were a few meters from the water and in direct sight of it. On March 2001 there were about 2500 Heermann's Gulls, many nesting on a 45° slope on the southern side of the island. By May, breeding was widespread over the island, from the flat top of the island to the 45° southern slope. We counted 466 chicks, but this was an underestimate, as many of the chicks were well hidden and most of the area was too dangerous to be inspected directly. We estimated that a few hundred pairs were breeding at the time. One chick regurgitated a Pelagic Tuna Crab (*Pleuroncodes planipes*).

Yellow-footed Gull (*Larus livens*). On 13 April 1999 we observed a few dozen adults standing near the water on the eastern side of the island. The place was typical of the nesting habitat of this species, but we could not assess whether the gulls were nesting at this time. This species was not seen in April 2000, and a careful scrutiny of the entire island in May 2001 produced no evidence of its breeding.

In May 2001, in search of nesting Craveri's Murrelets (*Synthliboramphus craveri*) and storm-petrels (*Oceanodroma* spp.), we examined a number of crevices but were unsuccesful in finding any of these birds. Only one Black Storm-petrel (*O. melania*) was seen on this date, flying midway between the island and Topolobampo.

CONSERVATION RISKS

Despite a concrete staircase, Farallón de San Ignacio is little inviting to exploration. In the past, guano was extracted from this island, but the island's small size and difficult access, plus the extensive use of synthetic fertilizers now, makes it unlikely that guano extraction will some day resume there. The island's difficult access makes other sources of human disturbance of the colonies also unlikely to be a major threat.

On the other hand, every time we landed on the island we found dead Black Rats (*Rattus rattus*), previously unreported from this island (Mellink 2002a). It is likely that rats were introduced at the time of guano extraction around the turn of the 20th century. Whether our failure to find nesting murrelets and storm-petrels is a result of the rat predation or a normal distributional feature we do not know, but eradication of the rats seems an appropriate management procedure.

ACKNOWLEDGMENTS

Jesús Manuel Arreola López provided transportation out of Topolobampo, while Richard Kelton and crew provided transportation for Mellink aboard the ketch *Enchantress*. Carlos Payán Esquerra assisted during field work. Kimball Garrett, Héctor Gómez de Silva, and Robert A. Hamilton provided important editorial comments. To all of them, our appreciation.

LITERATURE CITED

American Ornithologists' Union. 1957. Check-list of North American Birds, 5th ed. Am. Ornithol. Union, Baltimore.

American Ornithologists' Union. 1998. Check-list of North American Birds, 7th ed. Am. Ornithol. Union, Washington, D.C.

Everett, W. T., and Anderson, D. W. 1991. Status and conservation of the breeding seabirds on offshore Pacific islands of Baja California and the Gulf of California. Int. Council Bird Preserv. Tech. Publ. 11:115–139.

Fraser, C. M. 1943. General account of the scientific work of the *Velero III* in the eastern Pacific, 1931–1941. Allan Hancock Pacific Expeditions 1:49–258.

Hutchinson, G. E. 1950. The biogeochemistry of vertebrate excretion. Bull. Am. Mus. Nat. Hist. 96:1–554.

Mailliard, J. 1923. Expedition of the California Academy of Sciences to the Gulf of California in 1921: The birds. Proc. Calif. Acad. Sci. 12:443–456.

Mellink, E. 2000. Breeding of Brown Boobies in the Gulf of California: Seasonality and apparent effects of El Niño. Waterbirds 23:89–99.

Mellink, E. 2001. History and status of the colonies of the Heermann's Gull in Mexico. Waterbirds. Waterbirds 24:188–194.

Mellink, E. 2002a. Invasive vertebrates on islands of the Sea of Cortés, in Invasive Exotic Species in the Sonoran Region (B. Tellman, ed.), pp. 112–125. Univ. of Ariz. Press, Tucson.

Mellink, E. 200b. Pseudo-eggs of Brown and Blue-Footed Boobies in the Gulf of California, México. Marine Ornithol. 30:43–44.

Nelson, J. B. 1978. The Sulidae: Gannets and Boobies. Oxford Univ. Press, Oxford, England.

Osorio-Tafall, B. F. 1944. La expedición del M. N. "Gracioso" por aguas del extremo noroeste mexicano. Anales de la Escuela Nacional de Ciencias Biológicas 3:331–360.

Tershy, B. R., and Breese, D. 1997. The birds of San Pedro Mártir Island, Gulf of California, Mexico. W. Birds 28:96–107.

Velarde, E., and Anderson, D. W. 1994. Conservation and management of seabird islands in the Gulf of California: Setbacks and successes, in Seabirds on Islands: Threats, Case Studies and Action Plans (D. N. Nettleship, J. Burger, and M. Gochfeld, eds.), pp. 721–767. Int. Council Bird Preserv., Cambridge, England.

Vogt, W. 1946. Report of an airplane inspection trip made over the islands in the Gulf of California and off the Pacific coast of Lower California, in Report on activities of the conservation section, pp. 112–118 (Appendix IV). Division of Agricultural Cooperation, Pan-American Union, 1943–1946, Washington, D.C.

Accepted 18 November 2002

NOTES

FIRST RECORD OF DOUBLE BROODING BY THE COMMON RAVEN

WILLIAM C. WEBB, College of Forest Resources, University of Washington, Box 352100, Seattle, Washington 98195-2100

NORMAN C. ELLSTRAND, Department of Botany and Plant Sciences, University of California, Riverside, California 92521

The Common Raven (*Corvus corax*) ranges throughout the Holarctic, but many life-history attributes of this species, including mean lifespan, age at first breeding, age-specific fecundity, and other important variables, remain poorly documented (Boarman and Heinrich 1999). During the spring of 2001, we observed a single pair of ravens successfully rear two broods from a nest located on the campus of the University of California, Riverside. Prior to our observations, ravens had been known to produce only replacement clutches after loss of eggs (Bowles and Decker 1930) or nestlings (Stiehl 1985). In the case we describe below, a pair of ravens raised a second brood apparently in response to a short period of fledgling dependence rather than producing a second clutch in response to a loss of eggs or nestlings. This constitutes the first record of double brooding for the Common Raven.

We located the raven nest on a third-floor window awning approximately 75 m north of Ellstrand's office in an adjacent building on campus. We monitored the nesting behavior from Ellstrand's office and from the grounds nearby, observing the ravens successfully rear two broods. Both broods fell within the usual dates for the raven nesting season (Stiehl 1985, Ratcliffe 1997, Boarman and Heinrich 1999). The pair initiated nesting relatively early in the spring of 2001, with incubation beginning approximately 4 March (Figure 1). This first brood fledged around 3 May. At this time we observed a family group of ravens consisting of two fledglings and two adults in the natal territory.

The fledglings were absent from the natal territory by 15 May when we first observed incubation of the second brood. On the basis of the typical incubation period of 3 weeks (Boarman and Heinrich 1999), we estimate that laying of the second clutch began as early as 9 May. Three nestlings from the second brood were visible by 5 June, and they reached nearly adult size in early July. The second brood fledged on 4 July and accompanied the adults in the natal territory during the following week.

Raven fledglings normally remain in their natal territory for a period of 1 to 6 weeks while the parents continue feeding them (Ratcliffe 1997, Boarman and Heinrich 1999, Webb 2001). In the case of the Riverside nest, both broods remained in the natal territory for less than a week after fledging, a relatively short period. Short periods of fledgling dependence are most often associated with mortality before independence is reached (Verhulst and Hut 1996). Raven fledglings fly poorly and often succumb to predators (Ratcliffe 1997, Webb 2001). Most mortality (87%) of hatching-year ravens occurs when fledglings are dependent (Webb 2001). In the Mojave Desert, Coyotes (*Canis latrans*) account for at least 33% of raven fledgling mortality (Webb 2001). The University of California Riverside campus hosts a population of Coyotes and other mesopredators including the Gray Fox (*Urocyon inereoargenteus*), Bobcat (*Felis rufus*), and feral domestic cat (*Felis silvestris catus*). When the fledglings from the first and second brood appeared missing, we searched the natal territory but found no carcasses.

Renesting can occur when the environment remains favorable and nesting birds retain enough energy for reproduction. Previous studies found that relative reproduc-

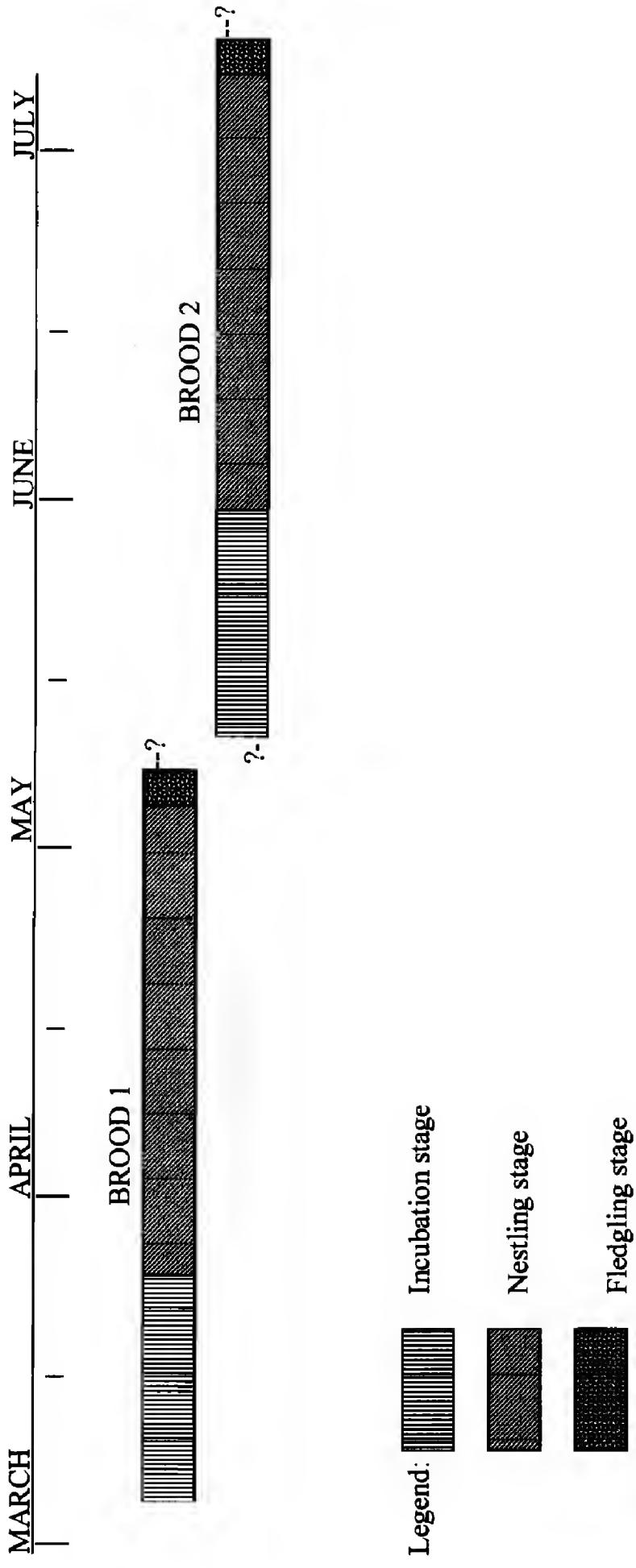


Figure 1. Chronology of a Common Raven nest at Riverside, California, in 2001.

tive efforts of consecutive broods are correlated (Smith et al. 1987, Linden 1988, Conrad and Robertson 1992), and the probability of renesting depends in some degree on the amount of post-fledging care (Hegner and Wingfield 1987, Tinbergen 1987). In the case of the Riverside nest, the short fledgling-dependence period (a likely result of fledgling mortality) probably combined with an abundance of nearby anthropogenic resources to facilitate renesting.

Although neither adult was marked, we are reasonably confident that the second brood was produced by the same pair of birds. Ravens are strongly territorial (Armstrong 1958, Craighead 1979, Davis and Davis 1986, Cramp and Perrins 1994) and defend their nesting territories throughout the year (Ratcliffe 1997), making the invasion of a second pair unlikely. Invasion of the nesting territory by a new pair would require displacement of the existing pair. Because suitable nest locations are abundant in the area, a new pair would be more likely to establish a separate territory rather than to displace the existing pair.

Death of one nesting adult followed by rapid replacement with a new mate is an unlikely explanation because survival rates of adult ravens are believed to be high (Ratcliffe 1997). Although rapid remating has been noted previously (Stiehl 1985, Ratcliffe 1997), it has been observed only after early nest failure, not after successful fledging, and never as late as May (Boarman and Heinrich 1999). Extreme wildlife hazards capable of killing an entire raven family (e.g., poisoned carcasses, hunters) occur in some regions of California (Webb 2001) but are absent from the suburban environment of Riverside. Thus, we believe that mortality of the entire initial family group followed by rapid replacement with another nesting pair is also unlikely.

Genetically influenced behavioral differences might explain the occurrence of the second brood. Double brooding could be more common in the small subspecies of raven prevalent in California (*C. c. clarionensis*) (Rea 1983, 1986) but not previously detected because most previous studies of ravens in North America concern the widespread *C. c. principalis*. Omland et al. (2000) suggested that the majority of ravens from California are genetically divergent from a holarctic clade consisting primarily of *C. c. principalis* and other subspecies.

Several other North American species of the tribe Corvini have been known to raise more than one brood (Ehrlich et al. 1988), including the Pinyon Jay (*Gymnorhinus cyanocephalus*), Blue Jay (*Cyanocitta cristata*), Brown Jay (*Cyanocorax morio*), American Crow (*Corvus branchyrhynchos*), and Northwestern Crow (*Corvus caurinus*).

We thank William I. Boarman for reviewing an earlier version of the manuscript, which was also greatly improved by thoughtful comments provided by Michael A. Patten and Brian L. Sullivan.

LITERATURE CITED

Armstrong, E. 1958. The Folklore of Birds. Collins, London.

Boarman, W. I., and Heinrich, B. 1999. Common Raven (*Corvus corax*), in The Birds of North America (A. Poole and F. Gill, eds.), no. 476. Acad. Nat. Sci., Philadelphia.

Bowles, J. H., and Decker, F. R. 1930. The Ravens of the state of Washington. Condor 32:192–201.

Conrad, K. F., and Robertson, R. J. 1992. Intraseasonal effects of clutch manipulation on parental provisioning and residual reproductive value of Eastern Phoebes (*Sayornis phoebe*). Oecologia 89:356–364.

Craighead, F. G., Jr. 1979. Track of the Grizzly. Sierra Club, San Francisco.

Cramp, S., and Perrins, C. M., eds. 1994. The Birds of the Western Palearctic, vol.

8. Oxford Univ. Press, Oxford, England.

Davis, P. E., and Davis, J. E. 1986. The breeding biology of a Raven population in central Wales. Nature in Wales 3:44–54.

Erhrlich, P. R., Dobkin, D. S., and Wheye, D. 1988. The Birder's Handbook: A Field Guide to the Natural History of North American Birds. Simon and Schuster, New York.

Hegner, R. E., and Wingfield, J. C. 1987. Effects of brood-size manipulation on parental investment, breeding success, and reproductive endocrinology of House Sparrows. Auk 104:470–480.

Linden, M. 1988. Reproductive trade-off between first and second clutches in the Great Tit *Parus major*: An experimental study. Oikos 51:285–290.

Omland, K. E., Tarr, C. T., Boarman, W. I., Marzluff, J. M., and Fleischer, R. C. 2000. Cryptic genetic variation and paraphyly in ravens. Proc. R. Soc. London. 267:2475–2482.

Ratcliffe, D. 1997. The Raven. Academic Press, San Diego.

Rea, A. M. 1983. Once a River. Univ. Ariz. Press, Tucson.

Rea, A. M. 1986. *Corvus corax* L.: Geographic variation, in The Known Birds of North and Middle America (A. R. Phillips, ed.), pt. 1, pp. 65–66, 214. A. R. Phillips, Denver.

Smith, H. G., Kallander H., and Nilsson, J. A. 1987. Effect of experimentally altered brood size on frequency and timing of second clutches in the Great Tit. Auk 104:700–706.

Stiehl, R. B. 1985. Brood chronology of the Common Raven. Wilson Bull. 97:78–87.

Tinbergen, J. M. 1987. Costs of reproduction in the Great Tit: Intraseasonal costs associated with brood size. Ardea 75:111–122.

Verhulst, S., and Hut, R. A. 1996. Post-fledging care, multiple breeding and the costs of reproduction in the Great Tit. Anim. Behav. 51:957–966.

Webb, W. C. 2001. Common Raven (*Corvus corax*) juvenile survival and movements in a human-augmented landscape. M. S. thesis, Univ. Calif., Riverside.

Accepted 28 October 2002

A WESTERN SCRUB-JAY PREYING ON DEER MICE

DAVID S. TINNIN, Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131

Scrub-jays of the genus *Aphelocoma* are known to be omnivorous and opportunistic in their feeding habits (Bent 1946). Stomach-content analyses of Florida Scrub-Jays (*A. coerulescens*) have shown that they feed predominantly on vegetable matter but that they also take large quantities of insects as well as frogs and lizards (Sprunt 1946). *Aphelocoma* spp. are also well known for raiding nests of other birds (Bent 1946, Haemig 1988). Although there are reports of Western Scrub-Jays (*A. californica*) preying on starlings and swallows (Ehrlich and McLaughlin 1988), as well as reports of Florida Scrub-Jays killing mockingbirds (Curry 1990), there have apparently been no previously reported field observations of their taking mammals.

On the morning of 25 April 2002, I was conducting small mammal mark–recapture work in piñon–juniper (*Pinus edulis–Juniperus monosperma*) woodland in the western foothills of the Sandia Mountains of central New Mexico (35° 17′ N, 106° 28′ W, 1890 m). I had captured two mice (*Peromyscus*) in succession on my trapline and had settled under a mixed clump of trees to record data on these animals.

At 08:15 I released the first, a 21-g adult male Piñon Mouse (*P. truei*), and started to process the second. At that point a commotion attracted my attention. Approximately 10 m away under a short (2 m) juniper, a Western Scrub-Jay was attempting to capture the just-released mouse, chasing him in, around, and through the scrubby low-lying branches. The jay alternated pecking at the mouse and flipping it a few inches into the air as the mouse bit at his assailant. The struggle lasted for approximately two minutes until the jay finally killed the mouse. The jay then flew off with its prey and landed behind a clump of juniper 20 m away.

As I circled around the trees to get a closer look the jay left the mouse and flew to the top of a tall piñon tree (~5 m), which was the highest vantage point in the immediate area. After I approached a few steps closer to the spot where it had dropped the prey, the jay retrieved the dead mouse and flew behind another clump of trees 10 m farther away. It immediately dropped the mouse and returned to its perch atop the piñon. For approximately five minutes I searched for the *Peromyscus* and then observed the jay for another few minutes while it remained on its perch watching me intently.

I then returned to process the remaining White-footed Mouse (*P. leucopus*), also an adult male (18 g.). Although I moved farther behind another clump of trees to block my release of the mouse from the view of the scrub-jay, it immediately swooped down again as I released the mouse. This time the struggle took place approximately 1 m from me within a large clump of piñon and juniper. As in the first incident, the jay weaved in and around the trees but took less than a minute to complete the capture. The jay then flew straight away, and I lost sight of the bird.

Scrub-jays are common in the area and at times can be a great nuisance to small-mammal trapping. They frequently steal bait and bedding from Sherman live-traps as well as generally disturb them and trip them closed. However bold they may be when our backs are turned, the jays are typically reticent about approaching or allowing humans to approach closer than approximately 5 m.

Although it might seem abnormal behavior—the diurnal scrub-jay preying on nocturnal *Peromyscus*—evidence from stomach analyses indicates that these jays do occasionally prey on small mammals. In northern California, Beal (1910) found that the total stomach contents consisted of 27% animal matter and 73% vegetable matter. In spring the proportion of animal matter was 70% of the diet. The animal matter

primarily consisted of beetles, caterpillars, and bird eggs. Of 326 stomachs analyzed, however, 11 contained bones of rodents and shrews.

This incident occurred in the spring of a particularly dry year for the area, in which precipitation was less than 50% of normal. There was little in the way of spring annuals or arthropods available (Ryan Swarz pers. comm.). The appearance of rodents easily available as prey items during a lean spring may have been too good an opportunity for the scrub-jay to resist, even with me so close.

I thank William L. Gannon and Robert W. Dickerman for reviewing early drafts of this manuscript. Financial support was provided by the Centers for Disease Control and Prevention under cooperative agreement number US3/CCU613416-07 and IPA number 01IPA12004.

LITERATURE CITED

Beal, F. E. L. 1910. Birds of California in relation to the forest industry, part 2. Biol. Surv. Bull. 34.

Bent, A. C., ed. 1946. Life histories of North American jays, crows, and titmice. U. S. Natl. Mus. Bull. 191.

Curry, R.L. 1988. Florida Scrub Jay kills a mockingbird. Condor 92:256–257.

Ehrlich, P. R., and McLaughlin, J. F. 1988. Scrub Jay predation on starlings and swallows: Attack and interspecific defense. Condor 90:503–505.

Haemig, P. D. 1988. Island Scrub Jay predation on cliff nests of House Finches. Wilson Bull. 100:140.

Sprunt, A., Jr. 1946. *Aphelocoma coerulescens coerulescens* (Bosc): Florida Jay , in Life histories of North American jays, crows, and titmice (A. C. Bent, ed.), pp. 77–86. U. S. Natl. Mus. Bull. 191.

Accepted 18 November 2002

FIRST RECORD OF LEACH'S STORM-PETREL IN THE GULF OF CALIFORNIA, MEXICO

FERNANDO PUEBLA-OLIVARES, OCTAVIO R. ROJAS-SOTO, and ADOLFO G. NAVARRO S., Museo de Zoología "Alfonso L. Herrera," Facultad de Ciencias, Universidad Nacional Autónoma de México, Apdo. Postal 70-399, México, D. F. 04510, Mexico

Leach's Storm - Petrel (*Oceanodroma leucorhoa*) is a widespread bird of the North Pacific and North Atlantic oceans, in the former breeding south to islands off western Mexico (AOU 1998). Four populations, differing mainly in the color of the rump, have been identified in western Mexico, breeding on Los Coronados (variably white rump), islets off Guadalupe Island in both summer and winter (white rump), and the San Benito Islands (dark rumped). Furthermore, nonbreeding migrants, possibly from much farther north, occur south in the Pacific Ocean to about 15° S, mainly over offshore waters. The species has not been found previously in the Gulf of California (Pitman 1986, Howell and Webb 1995).

At 0700 on 14 April 2000, one hour before arriving at Mazatlán, Sinaloa (at the mouth of the Gulf of California), we collected a Leach's Storm-Petrel in the dining room of the ferry from La Paz, Baja California Sur. The bird had been on board for an unknown period. It was a juvenile male (testis 1.5 mm), skull 80% pneumatized, with body molt and little fat. Body measurements: wing chord 160 mm, tail length 78.3 mm, tail fork depth 15.1 mm, exposed culmen 14.7 mm (including the tubular nostrils), middle toe 23.5 mm, tarsus 25.2 mm. The specimen was deposited in the ornithological collection of the Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México (MZFC 16316).

This record is the nearest reported to the continental coast of Mexico in the Gulf of California and can be considered as a vagrant. However, it is possible that the species occurs as a regular visitor in low densities in the southern Gulf of California. The specimen has white uppertail coverts, but, without critical specimen comparison, we are unable to assign it to subspecies. Additional field work is needed to determine this species' status in the Gulf of California and to determine which subspecies occur(s) there.

We thank the Consejo Nacional de Ciencia y Tecnología (CONACyT R27961), DGAPA-UNAM (IN 214200), Facultad de Ciencias–UNAM, and the Programa de Apoyo para Estudios de Posgrado (PAEP-UNAM 101331) for financial support. Steve N. G. Howell, Robert A. Hamilton, and Lorrain Giddings provided valuable comments on the manuscript. we also thank Patricia Escalante for access to the collection of the Instituto de Biología, UNAM. The Instituto Nacional de Ecología provided the scientific collector's permit (FAUT 0034).

LITERATURE CITED

American Ornithologists' Union. 1998. Check-list of North American Birds, 7th ed. Am. Ornithol. Union, Washington, D.C.

Howell, S. N. G., and Webb, S. 1995. A Guide to the Birds of Mexico and Northern Central America. Oxford Univ. Press, Oxford, England.

Pitman, R. L. 1986. Atlas of seabird distribution and relative abundance in the eastern tropical Pacific. Natl. Mar. Fish. Serv. Admin. Rep. LJ-86-02C.

Accepted 11 April 2002

BOOK REVIEW

A Complete Guide to Antarctic Wildlife: The Birds and Mammals of the Antarctic Continent and Southern Ocean, by Hadoram Shirihai. 2002. Alula Press, Helsinki, Finland. 510 pages, 35 color plates by Brett Jarrett, 600 color photos. Hardback, 59.90 euros (about $60 US). ISBN 951-98947-0-5.

Antarctica and the southern seas are among the last true wildernesses on Earth. Few are lucky enough to visit these areas, and, until now, no single guide has covered their wildlife in a modern format. For readers of *Western Birds* this book's main interest lies in the treatment of southern seabirds that have occurred, or could occur, in North American waters: 106 pages, 9 color plates, and 126 color photos (84 of albatrosses) are devoted to the Procellariiformes.

The book starts with lengthy acknowledgments, a review of the area covered (the Antarctic continent north to the Subtropical Convergence or latitude 40° S), and a summary of Antarctic exploration. Then follow species accounts for birds, seals, and cetaceans, descriptions of subdivisions within the region and of adjacent areas (so-called "gateways" to the Antarctic, such as Tierra del Fuego), a bibliography, and an index. The species accounts include color plates (with birds not necessarily to scale, e.g., Plate 8), color maps, a description (including sections on voice, size, and similar species), and notes on distribution, biology, conservation, and taxonomy. Good-quality photos are included for many species, usually with date, location, and comments about identification. Photos are unnumbered and so are unreferenced in the text. The book is tastefully designed and produced on high-quality glossy paper.

I will restrict this review largely to its potential interest for North American readers, who might turn first to the Shy Albatross taxa in hope of enlightenment. The text is responsibly conservative about problems inherent in separating adult Shy (*Thalassarche* [*c.*] *cauta*) and White-capped (*T.* [*c.*] *steadi*) albatrosses at sea but supports the identification of the 1999 California adult as nominate *cauta* (Cole 2000). Nothing new is added about the separation of immatures, including Salvin's and Chatham albatrosses. For the Wandering Albatross group, Shirihai states clearly that his treatment is provisional and that albatross taxonomy is in a state of flux. This recognition of a dynamic situation, rather than forcing things into a rigid framework, is commendable. *Seventeen* pages then tell us that three of the five Wandering Albatross taxa are not safely identifiable at sea—unless the age and sex (and in some cases breeding location!) are known. Until the immature plumage stages of the nominate Wandering Albatross are understood, and perhaps even then, the at-sea identification of these ocean giants will remain conjectural at best.

The accounts for other Procellariiformes provide useful information and some great photos, such as that of a Pycroft's Petrel on p. 154. The usually brief discussions of flight behavior, structure, and similar species suggest the author is unfamiliar with several species at sea (e.g., De Filippi's Petrel, which doesn't occur in the region but is included nonetheless). Real-life identification problems are often greater than suggested; for example, the separation of bleached immature Sooty and Light-mantled Sooty albatrosses is treated superficially, and there are no photos or paintings of these confusing plumages. Some accounts rely on published (but inaccurate) sources and so do not correctly describe the juvenile Pale-faced Sheathbill, for example. The color maps indicate breeding locations (helpfully identified by numbers on each map) and at-sea distributions, the latter often grouped for similar taxa (e.g., the Shy Albatross complex). At-sea distributions are mostly accurate given the limited amount of data from which one can extrapolate, although I know of no basis for the mapping of the Brown Skua off western South America.

Taxa are named on the plates, and field marks are often noted next to the figures. Many of the tubenose plates are adequate for field identification and reflect good technical skill at painting. To their detriment, however, the plates look to be based

largely on photos rather than field sketches and critical at-sea observation. The plates suggest a lack of familiarity with avian anatomy (e.g., skuas with 11 or more primaries), reinforced by the bird-topography figure of an albatross (page 53) that erroneously features inner secondaries extending inward to the body (allegedly covered by the humerals). Plates of things other than seabirds are variably successful, but the anatomically challenged birds on Plate 22 (South Atlantic island passerines) are decidedly substandard. Most plates in my copy are deeply saturated with pigment, and in some cases (e.g., Plate 11, the Blue Petrel and prions) this reduces their usefulness for identification.

As in many other European-based works there is a bias in the bibliography, and, while the text is packed with information, few literature citations are provided. Popular European articles (e.g., on giant-petrels and skuas) are included in the bibliography, but relevant references from North America (e.g., Spear et al. 1992, Howell et al. 1996) and Australia (Eades et al. 1994) are absent—although information from some of these has been incorporated into the text. Editing slips are not rare: the maps and text may disagree (the Westland Petrel is not mapped east to South America), and references may not be in the bibliography (Jouventin et al. 1989, noted on p. 91).

Having written the above, I field-tested this book on a 19-day cruise to the Falklands, South Georgia, and the Antarctic Peninsula and saw how it worked for wildlife enthusiasts and birdwatchers with varying levels of ability. Closer scrutiny revealed that production and editing were hurried. Typos and discrepancies proved common, and deciphering some sentences was a challenge. The book is a triumph of circumlocution over concision: judicious editing could cut each species account by at least 10–20% while making it much more user-friendly, the plates are not grouped together for comparison, and the identification sections appear to have received no critical peer review. For example, there is no straightforward discussion of features distinguishing flying Wandering Albatrosses from Southern Royal Albatrosses as they are often seen at sea—not close enough for the Royal's dark tomium stripe to be seen. Or, if you think you have seen an immature South American Sea Lion, try checking the plates or "similar species" section to distinguish it from immature fur seals, a genuine concern for the non-specialist. The taxonomic status of shags in islands of the Scotia Arc was considered unresolved by Prince and Croxall (1996) but is "black-and-white" in this work (on the basis of what source?), except for disagreement between text and map for the distribution of South Georgia Shag at Shag Rocks. Taxonomic discussions for the Kelp Gull and Antarctic Tern are confused and confusing. The Pale-faced Sheathbill (p. 253) allegedly shows "limited seasonal plumage variation" (undescribed), though sheathbills have only a single molt and plumage each year (Burger 1996). The list of other such problems could fill pages.

A Complete Guide to Antarctic Wildlife is an ambitious undertaking that involved a considerable amount of work. Its strengths are the high-quality photos and the scope of information gathered in one place. The book's preface states the hope that "both casual visitors and scientists will find this a complete and up-to-date guide," and "one of the main emphases is ... the application of modern techniques to the identification of the region's bird [sic] and marine mammals." Casual visitors, however, will likely be overwhelmed by the density of information, and for them I recommend Soper (2000), a small, light, and user-friendly book designed for its audience. The present work fails as a scientific reference because of the virtual lack of citations; these should be included in any future edition. With perseverance, keen birdwatchers will find the book useful for identification, although in most cases a combination of Harrison (1987) and Enticott and Tipling (1997) suffices. The application of modern identification techniques in the present work falls short in many cases, as for immature albatrosses, skuas, and terns, but this is not necessarily a criticism of the author and artist. Rather, it reflects the difficulties of gaining sufficient field experience with these birds—which

is part of the draw for many to return again and again to the wonders of the Southern Ocean.

LITERATURE CITED

Burger, A. E. 1996. Family Chionidae: Sheathbills, in Handbook of the Birds of the World, vol. 3 (J. del Hoyo, A. Elliott, and J. Sargatal, eds.), pp. 546–555. Lynx Edicions, Barcelona.

Cole, L. W. 2000. A first Shy Albatross, *Thalassarche cauta*, in California and a critical re-examination of Northern Hemisphere records of the former *Diomedea cauta* complex. N. Am. Birds 54:124–135.

Eades, D. W., Scofield, P., and Reid, T. 1994. Sorting out Sooties. Wingspan, Sep., pp. 11, 36–39.

Enticott, J., and Tipling, D. 1997. Photographic Handbook of the Seabirds of the World. New Holland, London.

Harrison, P. 1987. Seabirds of the World, a Photographic Guide. Helm, London.

Howell, S. N. G., Webb, S., and Spear, L. B. 1996. Identification at sea of Cook's, De Filippi's, and Pycroft's petrels. W. Birds 27:57–64.

Prince, P. A., and Croxall, J. P. 1996. The birds of South Georgia. Bull. Brit. Ornithol. Club 116:81–104.

Soper, T. 2000. Antarctica: A Guide to the Wildlife, 3rd ed. Bradt Publ., Chalfont St. Peter, England.

Spear, L. B., Howell, S. N. G., and Ainley, D. G. 1992. Notes on the at-sea identification of some Pacific gadfly petrels (genus: *Pterodroma*). Colonial Waterbirds 15:202–218.

Steve N. G. Howell

FEATURED PHOTO

AGEING AND MOLT IN NONBREEDING BLACK-BELLIED PLOVERS

STEVE N. G. HOWELL and PETER PYLE, Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach, California 94970

The correct determination of a bird's age, both in the hand and in the field, can be useful for population studies, and necessitates an appreciation of molt patterns. Like most northern-hemisphere shorebirds, adult Black-bellied Plovers (*Pluvialis squatarola*) undergo a complete prebasic molt from fall into winter, while juveniles have only a partial molt in their first winter. The literature, however, contains conflicting information on the timing and number of molts undertaken by first-year Black-bellied Plovers. Paulson (1995) reported that the post-juvenile molt is surprisingly variable, but typically juveniles replace "most of body plumage ... late Sep through at least early Nov." For the western Palearctic, Cramp and Simmons (1983) noted that Black-bellied Plovers retain their juvenal plumage through autumn migration, into October or November and sometimes later. Byrkjedal and Thompson (1998) noted that postjuvenal molt does not usually start before mid November. The latter two accounts accord with the situation in California, on the basis of our observations at Bolinas Lagoon, Marin County, and 30 juveniles collected in California from mid September through late October (specimens at California Academy of Sciences [CAS]). Starting between November and January—and continuing for an indeterminate period (see below)—a variably extensive molt occurs, starting with the crown, mantle, and scapulars (Cramp and Simmons 1983; pers. obs.). This pattern of molt is reminiscent of certain large gulls, which retain juvenal plumage into winter (Howell et al. 1999, Howell 2001) but which were traditionally believed to have undergone an extensive postjuvenal molt in their first fall (Grant 1986). Some Black-bellied Plovers also replace a variable number of upperwing coverts and tertials from at least January onwards (CAS specimens; pers. obs.).

In their first spring, Black-bellied Plovers in California manifest a highly variable appearance: some have undergone extensive molt that includes 90% or more of their upperwing coverts whereas others have retained most or all of their juvenal upperwing coverts, which are then very bleached and worn. Birds showing extensive molt can be aged by their worn juvenal primaries and any retained juvenal wing coverts and tertials. Some first-spring birds are gray and white overall, resembling basic-plumaged adults, but others have a spattering of black feathers on the chest, belly, and flanks. For example, of 26 CAS specimens collected from central California in May of their second calendar year, 11 have some black on their underparts while 15 lack black; both types are well represented by males and females. Other individuals, perhaps mainly males (observed farther north and later in spring?), can attain mostly black underparts suggesting adults (e.g., University of Puget Sound specimen no. 17217, collected 12 May). The complete second prebasic molt occurs mainly from May to September (its start perhaps overlapping with the last stages of first-winter molt?), after which birds in their second calendar year resemble basic-plumaged adults (Cramp and Simmons 1983, Paulson 1995, Byrkjedal and Thompson 1998).

Thus Black-bellied Plovers undergo variable degrees of molt in their first winter and spring, followed by a complete molt into second basic plumage during the summer and fall of their second year. But how many times does a Black-bellied Plover molt in its first year? Most sources, e.g., Paulson (1995) and Byrkjedal and Thompson (1998), report that first-year birds have a variable first prealternate molt in spring, following their first prebasic molt in winter, with the latter authors noting that this molt is very

limited in extent. Cramp and Simmons (1983) implied that the birds molt directly from "first non-breeding" (= first basic) to "second non-breeding" (= second basic) plumage.

For two molts (and two plumages) to occur, a bird must replace some feathers more than once (Humphrey and Parkes 1959). The data from Cramp and Simmons (1983), plus our field work and specimen examination, suggest that there could be only a single molt in a Black-bellied Plover's first winter, as apparently occurs with large gulls (Howell 2001). Establishing whether there are two or one first-winter molts is problematic. The former interpretation, while possibly true, may in part be a legacy of studies of molt in passerines, in which discrete fall and spring molts do tend to be prebasic and prealternate, respectively. Specimens with extensive molt in midwinter and others with extensive molt in spring suggests that there are two molts—but no individual bird can be followed to prove this. First-spring birds with extensive bright feathering could be those that retained good-quality juvenal plumage longest and then attained a plumage resembling adult alternate; first-spring birds wearing a dull plumage like adult basic could be birds that molted early out of juvenal plumage. Differences in the color and pattern of feathers relate to molt timing and hormonal state of the bird, not necessarily to different molts (Herremans 1999, Howell 2001). Thus later-molting and hormonally more advanced birds could attain black underpart feathers and boldly checkered upperwing coverts in late winter and spring as part of the later stages of a single protracted or suspended first-winter molt.

The pattern of a single first-winter molt in species with definitive alternate plumages was termed the simple alternate strategy by Howell and Corben (2000). It may occur in a variety of species but has not been widely recognized. If Black-bellied Plovers do molt only once in their first winter this molt is phenotypically more similar to a definitive prealternate molt than to a prebasic molt—a characteristic of the simple alternate strategy (Howell and Corben 2000). The difficulty of following individual birds over time and distance has hindered elucidation of this strategy. A confounding factor is that plumage patterns and colors can change during the course of a single molt, and these different color patterns can be mistakenly equated with different molts.

The featured photos on the back cover show two Black-bellied Plovers in winter. The upper bird, photographed in San Mateo County, California, on 8 November 1992, is mostly if not entirely in juvenal plumage, typical of first-year birds at this season. The buff tones of fresh juvenal plumage have faded, and the plumage has become slightly worn. Post-juvenal molt, if it has occurred at all, has been limited. The age of the lower bird, photographed in Santa Barbara County, California, in January 1991, is more problematic. It could be a first-winter bird, perhaps with some molt of the scapulars, which look as though they might be slightly darker (and fresher?) than the paler upperwing coverts. But the primaries look relatively black and fresh, more typical of an adult. The tertial pattern is equivocal but these feathers look relatively unworn; most juveniles by this date have heavily abraded tertials with the pale lateral notches excavated. Adult tertials typically are more muted in pattern, with poorly contrasting pale brownish bands or notches, but some look similar to those of this bird. Alternatively, this bird's tertials may be postjuvenal feathers, although all first-winter specimens we examined at this season had two or more retained juvenal tertials. Until molt timing and extent, and variation in plumage characters such as tertial pattern, are well documented, ageing winter Black-bellied Plovers in the field will sometimes be difficult. And might some birds in second basic plumage be distinguishable?

Much remains to be learned about even our common shorebirds. We conclude that the jury is still out on the question of one versus two molts in first-winter Black-bellied Plovers. Perhaps some individual Black-bellied Plovers do have two first-winter molts while the second molt is suppressed in other individuals. Could such differences relate to the latitude of a bird's wintering grounds? We offer this note to stimulate thought about molting strategies in the Charadriiformes and other nonpasserines. Thanks to

Mike Danzenbaker (upper photo) and Larry Sansone (lower photo) for their contributions, and to Douglas J. Long (California Academy of Sciences) for access to specimens. This note benefited greatly by comments from Dennis Paulson and Danny I. Rogers and is Point Reyes Bird Observatory contribution 980.

LITERATURE CITED

Byrkjedal, I., and Thompson, D. B. A. 1998. Tundra Plovers. Poyser, London, England.

Cramp, S., and Simmons, K. E. L. (eds.). 1983. Handbook of the Birds of Europe, the Middle East, and North Africa, vol. 3. Oxford Univ. Press, Oxford, England.

Grant, P. J. 1986. Gulls: A Guide to Identification, 2nd ed. Academic Press, San Diego.

Herremans, M. 1999. Biannual complete moult in the Black-chested Prinia *Prinia flavescens*. Ibis 141:115–124.

Howell, S. N. G. 2001. A new look at moult in gulls. Alula 7:2–11.

Howell, S. N. G., and Corben, C. 2000. A commentary on molt and plumage terminology: Implications from the Western Gull. W. Birds 31:50–56.

Howell, S. N. G., King, J. R., and Corben, C. 1999. First prebasic molt in Herring, Thayer's, and Glaucous-winged gulls. J. Field Ornithol. 70:543–554.

Humphrey, P. S., and Parkes, K. C. 1959. An approach to the study of molts and plumages. Auk 76:1–31.

Paulson, D. R. 1995. Black-bellied Plover (*Pluvialis squatarola*), in The Birds of North America (A. Poole and F. Gill, eds.), no. 186. Acad. Nat. Sci., Philadelphia.

WESTERN BIRDS, INDEX, VOLUME 33, 2002

Compiled by Jack W. Schlotte and Philip Unitt

Accipiter cooperii, 38
striatus, 38, 42
Actitis macularia, 75, 76, 78, 79, 80, 82, 140, 141, 143, 144, 145, 146, 149, 151, 156–172, 222, 225, 226, 227, 228–229, 230, 233, 234
Aethia psittacula, 1, 14
Agelaius phoeniceus, 40
Aimophila cassinii, 186
ruficeps, 40
Aix sponsa, 38
Ajaia ajaja, 23
Albatross, Short-tailed, 5, 176, 178, 180
Shy, 1, 4–5, 9, 176, 178, 179
Alectoris chukar, 21
Amazilia violiceps, 2, 15
Amazona finschi, 21
viridigenalis, 1, 20–22
Ammodramus bairdii, 191
leconteii, 19
nelsoni, 19
Anas falcata, 2, 176
platyrhynchos, 38 252
querquedula, 8
Anderson, Betty A., see Quakenbush, L. T.
Anhinga, 23, 192, 199
Anhinga anhinga, 23, 192, 199
melanogaster, 2, 175, 192, 199
Anthropoides virgo, 2, 176
Anthus rubescens, 39
spragueii, 27, 185
Aphelocoma californica, 39, 42, 262–263
coerulescens, 262
Aphriza virgata, 73, 75, 78, 140, 170
Aquila chrysaetos, 241, 244, 245, 246
Archilochus alexandri, 38
colubris, 26
Ardea alba, 38, 249–250
herodias, 38, 249
Arenaria interpres, 73, 75, 77, 79, 140, 141, 143, 144, 145, 147, 156–170, 228–229, 234
melanocephala, 73, 75, 77, 79, 140, 162, 170
Auklet, Parakeet, 1, 14
Avocet, American, 75, 76, 78, 79, 80, 82, 86, 88, 91, 134, 139, 140, 141, 143, 144, 145, 147, 149, 150, 151, 156–172, 222, 225, 227, 228–229, 230, 231, 232, 234, 235, 251

Baeolophus inornatus, 39, 42
Bartramia longicauda, 9–10, 188
Bishop, Orange, 21
Blackbird, Brewer's, 28, 40
Red-winged, 40
Yellow-headed, 40
Black-Hawk, Common, 188
Great, 188
Bluebird, Eastern, 2, 27
Mountain, 27
Western, 27, 39, 42
Bobwhite, Northern, 2, 24
Bombycilla cedrorum, 39
Booby, Blue-footed, 256
Brown, 2, 7, 180, 187, 255
Masked, 3, 6–7, 176, 180, 187
Nazca, 2, 3, 7, 175–176, 180, 187
Red-footed, 181
Brachyramphus brevirostris, 190
marmoratus, 190, 215
perdix, 14, 176, 183, 190
Brant, 114
Branta bernicla, 114
Bubo virginianus, 38, 241, 244, 246
Bubulcus ibis, 250–251
Bunting, Lazuli, 40, 43
McKay's, 27
Painted, 2, 19–20, 28, 29, 176, 186, 192, 196
Snow, 16, 19, 27, 186
Yellow-breasted, 2, 176
Bushtit, 39, 41, 42
Buteo albonotatus, 188
jamaicensis, 38, 241, 244–245
lineatus, 38
swainsoni, 38
Buteogallus anthracinus, 188
urubitinga, 188

Calidris alba, 25, 75, 77, 79, 80, 82, 86, 92, 140, 141, 143, 144, 145, 147, 149, 156–172, 228–229, 234

alpina, 73, 75, 77, 78, 80, 82, 85, 137, 140, 141, 143, 144, 145, 147, 156–172
bairdii, 75, 78, 140, 141, 143, 144, 145, 146, 156–169, 172, 228–229
canutus, 25, 75, 77, 79, 80, 81, 82, 86, 90, 140, 141, 143, 144, 145, 147, 156–170, 228–229
ferruginea, 10, 25, 140, 170, 182
fuscicollis, 25, 182, 183, 188–189
himantopus, 25, 75, 78, 140, 141, 143, 144, 145, 157–165, 170
mauri, 70, 73, 74, 75, 77, 78, 80, 82, 85, 134, 137, 139, 140, 141, 143, 144, 145, 147, 149, 150, 156–172, 222, 226, 227, 228–229, 230, 231, 232, 233, 234, 235
melanotos, 75, 78, 140, 141, 144, 146, 156–167, 172, 228–229, 234
minutilla, 25, 73, 75, 77, 78, 80, 82, 85, 134, 137, 140, 141, 143, 144, 145, 147, 149, 150, 156–172, 222, 225, 226, 227, 228–229, 230, 233, 234, 235
pusilla, 75, 78, 140, 141, 143, 144, 146, 156–164, 228–229, 234
ruficollis, 25, 188
subminuta, 25
Callipepla californica, 38, 123
gambelii, 123
Calocitta colliei, 29
Calypte anna, 26, 38
Caracara, Crested, 188
Caracara cheriway, 188
Cardellina rubrifrons, 18
Cardinalis sinuatus, 19
Carduelis flammea, 28
pinus, 40
psaltria, 40, 43, 48
tristis, 40, 41, 43
Carmona, Roberto, Gorgonio Ruiz-Campos, José A. Castillo-Guerrero, and Efrén Hernández, Composition of Raptors on Espíritu Santo Island, Gulf of California, Mexico, 241–248
Carpodacus mexicanus, 40, 43
purpureus, 40
Casmerodius albus, 38, 249–250
Castillo-Guerrero, José A., see Carmona, R.; see Mellink, E.
Catbird, Gray, 17
Cathartes aura, 38, 241, 243, 244
Catharus fuscescens, 126, 127
guttatus, 39, 41, 42, 45, 47
minimus, 12, 17
ustulatus, 39, 42
Catoptrophorus semipalmatus, 70, 75, 76, 78, 79, 80, 82, 86, 88, 91, 140, 141, 143, 144, 145, 147, 149, 150, 151, 152, 156–172, 228–229
Cepphus columba, 190
Certhia americana, 39, 42, 48
Ceryle alcyon, 38
Chaetura vauxi, 38
Chamaea fasciata, 39, 42
Charadrius alexandrinus, 75, 76, 79, 80, 82, 89, 91, 140, 141, 144, 147, 149, 151, 156–172, 215, 222, 223, 225, 226, 227, 228–229, 230, 231, 232, 235, 236
leschenaultii, 2, 24, 175
mongolus, 24
montanus, 228–229, 234
morinellus, 176, 182
semipalmatus, 75, 76, 79, 80, 82, 86, 89, 92, 140, 141, 144, 145, 147, 151, 156–172, 222, 227, 228–229, 230, 232, 234
vociferus, 38, 75, 76, 78, 79, 80, 82, 89, 134, 140, 141, 142, 143, 144, 145, 146, 149, 151, 156–172, 222, 225, 227, 228–229, 230, 232, 234
wilsonia, 176, 182
Chat, Yellow-breasted, 40, 43, 48
Chickadee, Chestnut-backed, 127
Chlidonias leucopterus, 2, 11, 14
Chondestes grammacus, 40, 43, 48
Chordeiles acutipennis, 38
minor, 38
Chukar, 21
Circus cyaneus, 38, 241, 244, 246
Cistothorus palustris, 39, 42
platensis, 176, 185
Coccyzus americanus, 38
erythropthalmus, 183, 190
Colaptes auratus, 38, 42, 124
chrysoides, 124
Colinus virginianus, 2, 24
Collared-Dove, Eurasian, 2, 176
Columba livia, 21

Columbina talpacoti, 14, 26, 183, 190
Contopus pertinax, 15, 184
sordidulus, 26, 38, 42, 47
virens, 26
Coot, American, 38
Cormorant, Brandt's, 180
Double-crested, 23, 38, 256
Neotropic, 7
Corvus brachyrhynchos, 39, 202–217, 260
caurinus, 260
corax, 114, 202–217, 258–261
Coturnicops noveboracensis, 8
Cowbird, Brown-headed, 40, 43
Crane, Demoiselle, 2, 176
Sandhill, 38, 51–60
Whooping, 176
Creeper, Brown, 39, 42, 48
Crow, American, 39, 202–217
Northwestern, 260
Cuckoo, Black-billed, 183, 190
Yellow-billed, 38
Curlew, Long-billed, 75, 76, 80, 81, 82, 89, 94, 140, 141, 143, 144, 145, 146, 147, 149, 150, 151, 152, 156–172, 228–229
Cyanocitta cristata, 62, 260
Cyanocorax morio, 260
Cygnus buccinator, 8, 23–24
columbianus, 23–24
cygnus, 8
Cynanthus latirostris, 14–15, 184

Darter, 2, 175, 192, 199
Day, Robert H., see Quakenbush, L. T.
De la Cerda, Aimée, see Mellink, E.
Dendrocygna autumnalis, 7–8, 181
Dendroica castanea, 3
coronata, 39, 41, 43, 47, 48
dominica, 17–18
graciae, 191
nigrescens, 39, 43
petechia, 37, 39, 41, 43, 45, 47
pinus, 18, 185, 191
tigrina, 3
Dotterel, Eurasian, 176, 182
Dove, Eurasian Collared, 2, 176
Mourning, 38
Rock, 21
Ruddy Ground, 14, 26, 183, 190
Spotted, 21
Dowitcher, Long-billed, 25, 73, 75, 77, 134, 137, 138, 140, 141, 147, 148, 149, 159, 226
Short-billed, 73, 75, 77, 137, 138, 140, 141, 159, 226
sp., 78, 79, 80, 82, 83, 86, 87, 91, 143, 144, 145, 150, 157–172, 227, 228–229, 230, 233, 235
Duck, Black-bellied Whistling, 7–8, 181
Falcated, 2, 176
Masked, 2, 175, 188
Ruddy, 188
Wood, 38
Dumetella carolinensis, 17
Dunlin, 73, 75, 77, 78, 80, 82, 85, 137, 140, 141, 143, 144, 145, 147, 156–172
Dunn, Jon L., see Hamilton, R. A.

Eagle, Golden, 241, 244, 245, 246
Solitary, 188
Egret, Cattle, 250–251
Great, 38, 249–250
Reddish, 7, 176, 181, 250, 252
Snowy, 38, 127, 250
Egretta caerulea, 187
rufescens, 7, 176, 181, 250, 252
thula, 38, 127, 250
tricolor, 7, 181, 187, 250, 252
Eider, King, 181
Steller's, 99–120
Elanus leucurus, 38
Ellstrand, Norman C., see Webb, W. C.
Emberiza aureola, 2, 176
Empidonax alnorum, 176, 184, 193
difficilis, 39, 41, 42, 45, 47
flaviventris, 15, 26, 190
hammondii, 39
oberholseri, 39, 42, 48
traillii, 38, 41, 42, 45, 47, 184
wrightii, 39, 42, 48
Erickson, Richard A., see McKee, T.
Etienne, Katherine L., see Kelly, J. P.
Eudocimus albus, 187
Euphagus cyanocephalus, 28, 40
Euplectes franciscanus, 21

Falco columbarius, 38
peregrinus, 241, 244, 245
sparverius, 38, 241, 244, 245
Falcon, Peregrine, 241, 244, 245
Finch, Black Rosy, 20
House, 40, 43
Purple, 40
Flamingo, Chilean, 23
Lesser, 23
Flicker, Gilded, 124

Northern, 38, 42, 124
Red-shafted, 38, 42
Floyd, Ted, Book Review: Oregon Breeding Bird Atlas, 125–127
Flycatcher, Alder, 176, 184, 193
Ash-throated, 39, 42
Dusky, 39, 42, 48
Dusky-capped, 15, 26, 184
Gray, 39, 42, 48
Gray Silky, 28–29
Great Crested, 15, 191
Hammond's, 39
Nutting's, 2, 175, 184–185, 193
Pacific-slope, 39, 41, 42, 45, 47
Scissor-tailed, 16
Sulphur-bellied, 15
Western, 39, 41, 42, 45, 47
Willow, 38, 41, 42, 45, 47, 184
Yellow-bellied, 15, 26, 190
Fong-Mendoza, José R., see González-Bernal, M. A.
Fulica americana, 38
Fulmar, Northern, 121
Fulmarus glacialis, 121

Gallinago delicata, 38, 75, 78, 140, 141, 143, 144, 145, 147, 149, 151, 157–172, 225, 226, 228–229, 235, 236
Gallinula chloropus, 38
Garganey, 8
Garrett, Kimball L., Featured Photo: Tree-Nesting Cliff Swallows in the San Bernardino Mountains, California, 65–66
Gavia adamsii, 178, 187
arctica, 2, 4, 187
Geothlypis trichas, 39, 41, 43
Geupel, Geoffrey R., see Humple, D. L.
Gnatcatcher, Black-tailed, 123
Blue-gray, 39, 42
California, 123
Godwit, Bar-tailed, 10, 182
Hudsonian, 10, 140, 182
Marbled, 70, 75, 76, 78, 79, 80, 82, 86, 87, 91, 134, 140, 141, 143, 144, 145, 147, 149, 150, 156–172, 228–229
Golden-Plover, American, 78
Pacific, 78
Goldfinch, American, 40, 41, 43
Lesser, 40, 43, 48
González-Bernal, Marco A., Eric Mellink, and José R. Fong-Mendoza, Nesting Birds of Farallón de San Ignacio, Sinaloa, Mexico, 254–257
Grackle, Common, 20, 28, 186, 191–192
Great-tailed, 28
Grebe, Eared, 223
Pied-billed, 38
Greenshank, Common, 2, 175
Grosbeak, Black-headed, 40, 43, 48
Blue, 40, 43
Ground-Dove, Ruddy, 14, 26, 183, 190
Grus americana, 176
canadensis, 38, 51–60
Guillemot, Pigeon, 190
Guiraca caerulea, 40, 43
Gull, Band-tailed, 189
Bonaparte's, 245
California, 223, 235
Glaucous, 114, 189, 218, 219
Glaucous-winged, 25, 218, 219
Heermann's, 256
Herring, 13, 25, 189, 218, 219
Iceland, 25, 189, 218
Kumlien's, 218, 219
Laughing, 251
Lesser Black-backed, 11, 12–13, 183, 189
Little, 12, 25, 182
Slaty-backed, 2, 25, 175, 189, 197, 218
Thayer's, 25, 189, 218, 219
Western, 218, 219
Yellow-footed, 256
Gymnorhinus cyanocephalus, 260

Haematopus bachmani, 9, 24, 73, 75, 78
palliatus, 8–9, 24
Hamilton, Robert A., and Dunn, J. L., Featured Photo: Red-naped and Red-breasted Sapsuckers, 128–130; and Steve N. G. Howell, Gnatcatcher Sympatry near San Felipe, Baja California, with Notes on Other Species, 123–124
Harpyhaliaetus solitarius, 188
Harrier, Northern, 38, 241, 244, 246
Hawk, Common Black, 188
Cooper's, 38
Great Black, 188
Harris', 8, 28, 182, 241, 244, 245, 246
Red-shouldered, 38

Red-tailed, 38, 241, 244–245
Sharp-shinned, 38, 42
Swainson's, 38
Zone-tailed, 188
Helmitheros vermivorus, 18, 27, 186, 191
Hernández, Efrén, see Carmona, R.
Heron, Black-crowned Night, 38, 250, 251
Great Blue, 38, 249
Little Blue, 187
Tricolored, 7, 181, 187, 250, 252
Yellow-crowned Night, 181
Heteroscelus incanus, 73, 75, 78
Hickey, Catherine M., see Stenzel, L. E.
Himantopus mexicanus, 75, 76, 79, 80, 82, 91, 134, 139, 140, 141, 142, 143, 144, 145, 146, 149, 150, 156–172, 225, 228–229
Hirundo pyrrhonota, 27, 39, 65–66
rustica, 27, 39
Howell, Steve N. G., Featured Photo: Identification Problems with Large Gulls, 218–219; Book Review: A Complete Guide to Antarctic Wildlife, 265–267; Featured Photo: Ageing and Molt in Nonbreeding Black-bellied Plovers, 268–270; see Hamilton, R. A.
Hummingbird, Anna's, 26, 38
Black-chinned, 38
Broad-billed, 14–15, 184
Ruby-throated, 26
Rufous, 38
Violet-crowned, 2, 15
Xantus', 184
Humple, Diana L., and Geoffrey R. Geupel, Autumn Populations of Birds in Riparian Habitat of California's Central Valley, 34–50
Hylocharis xantusii, 184
Hylocichla mustelina, 17

Ibis, Glossy, 2, 175, 181
White, 187
White-faced, 61, 181
Icteria virens, 40, 43, 48
Icterus abeillei, 2, 176
bullockii, 40, 43
Ictinia mississippiensis, 8, 182
Ixoreus naevius, 39

Jaeger, Pomarine, 115
Jaramillo, Alvaro, see Rogers, M. M.
Jay, Black-throated Magpie, 29
Blue, 62, 260
Brown, 260
Florida Scrub, 262
Pinyon, 260
Western Scrub, 39, 42, 262–263
Junco, Dark-eyed, 40, 43
Junco hyemalis, 40, 43

Kelly, John P., Katherine L. Etienne, and Jennifer E. Roth, Abundance and Distribution of the Common Raven and American Crow in the San Francisco Bay Area, California, 202–217
Kestrel, American, 38, 241, 244, 245
Killdeer, 38, 75, 76, 78, 79, 80, 82, 89, 134, 140, 141, 142, 143, 144, 145, 146, 149, 151, 156–172, 222, 225, 227, 228–229, 230, 232, 234
Kingbird, Thick-billed, 15–16, 185
Western, 39
Kingfisher, Belted, 38
Kinglet, Golden-crowned, 39, 42
Ruby-crowned, 37, 39, 42, 44, 45
Kite, Mississippi, 8, 182
White-tailed, 38
Kjelmyr, Janet E., see Stenzel, L. E.
Knot, Red, 25, 75, 77, 79, 80, 81, 82, 86, 90, 140, 141, 143, 144, 145, 147, 156–170, 228–229

Lagopus leucurus, 21
Lanius ludovicianus, 39, 42
Larus argentatus, 13, 25, 189, 218, 219
atricilla, 251
belcheri, 189
californicus, 223, 235
fuscus, 11, 12–13, 183, 189
glaucescens, 25, 218, 219
glaucoides, 25, 189, 218, 219
heermanni, 256
hyperboreus, 114, 189, 218, 219
livens, 256
minutus, 12, 25, 182
occidentalis, 218, 219
philadelphia, 245
schistisagus, 2, 25, 175, 189, 197, 218
thayeri, 25, 189, 218, 219
Leucosticte atrata, 20
Limnodromus griseus, 73, 75, 77, 137, 138, 140, 141, 159, 226

scolopaceus, 25, 73, 75, 77, 134, 137, 138, 140, 141, 147, 148, 149, 159, 226
sp., 78, 79, 80, 82, 83, 86, 87, 91, 143, 144, 145, 150, 157–172, 227, 228–229, 230, 233, 235
Limosa fedoa, 70, 75, 76, 78, 79, 80, 82, 86, 87, 91, 134, 140, 141, 143, 144, 145, 147, 149, 150, 156–172, 228–229
haemastica, 10, 140, 182
lapponica, 10, 182
Littlefield, Carroll D., Winter Foraging Habitat of Greater Sandhill Cranes in Northern California, 51–60
Lonchura punctulata, 21, 29
Loon, Arctic, 2, 4, 187
Yellow-billed, 178, 187

Magpie, Black-billed, 127
Yellow-billed, 39
Magpie-Jay, Black-throated, 29
Mallard, 38, 252
Mannikin, Nutmeg, 21, 29
Martin, Purple, 245
McCaffery, Brian J., see Quakenbush, L. T.
McKee, Tristan, and Richard A. Erickson, Report of the California Bird Records Committee: 2000 Records, 175–201
Meadowlark, Western, 40, 188
Melanerpes erythrocephalus, 2, 15
formicivorus, 38
Melanotis caerulescens, 2, 175, 192, 200
Meleagris gallopavo, 21, 38
Mellink, Eric, José A. Castillo-Guerrero, Aimée de la Cerda, Noteworthy Waterbird Records in the Delta of the Río Colorado, Mexico, 249–253; see González-Bernal, M. A.
Melospiza lincolnii, 40, 41, 43, 44, 46, 47
melodia, 40, 43, 47
Mergellus albellus, 176, 181–182
Merlin, 38
Meyers, Martin, Book Review: Birds of the Lahontan Valley: A Guide to Nevada's Wetland Oasis, 61–62
Micrathene whitneyi, 241, 244, 246
Mimus polyglottos, 39, 43, 262
Mniotilta varia, 62
Mockingbird, Blue, 2, 175, 192, 200
Northern, 39, 43, 262
Molothrus ater, 40, 43
Moorhen, Common, 38
Motacilla alba, 176
lugens, 176, 185, 194
Murre, Common, 215
Thick-billed, 14
Murrelet, Craveri's, 256
Kittlitz's, 190
Long-billed, 14, 176, 183, 190
Marbled, 190, 215
Mycteria americana, 251–252
Myiarchus cinerascens, 39, 42
crinitus, 15, 191
nuttingi, 2, 175, 184–185, 193
tuberculifer, 15, 26, 184
Myiodynastes luteiventris, 15
Navarro-S., Adolfo G., see Puebla-Olivares, F.

Nighthawk, Common, 38
Lesser, 38
Night-Heron, Black-crowned, 38, 250, 251
Yellow-crowned, 181
Nomonyx dominicus, 2, 175, 188
Numenius americanus, 75, 76, 80, 81, 82, 89, 94, 140, 141, 143, 144, 145, 146, 147, 149, 150, 151, 152, 156–172, 228–229
phaeopus, 75, 76, 78, 79, 80, 82, 89, 140, 141, 143, 144, 145, 146, 147, 148, 150, 156–170, 228–229
Nuthatch, Red-breasted, 39
White-breasted, 39, 42
Nyctanassa violacea, 181
Nyctea scandiaca, 14, 115
Nycticorax nycticorax, 38, 250, 251

Oceanites oceanicus, 22, 23
Oceanodroma furcata, 121
leucorhoa, 264
markhami, 2, 175, 187
melania, 187, 256
tethys, 22–23, 24
tristrami, 187
Oporornis agilis, 13, 18, 186, 191
philadelphia, 3, 18, 27, 191
tolmiei, 39, 43, 44, 48
Oriole, Black-backed, 2, 176
Bullock's, 40, 43
Osprey, 38, 241, 243–244
Owl, Barn, 38
Elf, 241, 244, 246
Great Horned, 38, 241, 244, 246

Snowy, 14, 115
Oxyura jamaicensis, 188
Oystercatcher, American, 8–9, 24
Black, 9, 24, 73, 75, 78

Page, Gary W., see Stenzel, L. E.; see Shuford, W. D.
Pandion haliaetus, 38, 241, 243–244
Parabuteo unicinctus, 8, 28, 182, 241, 244, 245, 246
Parrot, Lilac-crowned, 21
Red-crowned, 1, 20–22
Passer domesticus, 21, 40
Passerculus sandwichensis, 40, 43, 48, 191
Passerella iliaca, 40, 41, 43, 44, 46, 47
Passerina amoena, 40, 43
caerulea, 40, 43
ciris, 2, 19–20, 28, 29, 176, 186, 192, 196
Paulson, Dennis R., Book Review: The Birds of Yakima County, Washington, 63–64
Pearce, John M., First Record of a Greater Shearwater in Alaska, 121–122
Pelecanus occidentalis, 192
rufescens, 2, 175, 192, 198
Pelican, Brown, 192
Pink-backed, 2, 175, 192, 198
Petrel, Black Storm, 256
Dark-rumped, 176, 179–180
Fork-tailed Storm, 121
Galapagos, 176, 179
Great-winged, 2, 5, 10
Hawaiian, 176, 179
Leach's Storm, 264
Markham's Storm, 2, 175, 187
Murphy's, 5
Solander's, 5
Wedge-rumped Storm, 22–23, 24
Wilson's Storm, 22, 23
Petrochelidon fulva, 27
pyrrhonota, 27, 39, 65–66
Pewee, Eastern Wood, 26
Greater, 15, 184
Western Wood, 26, 38, 42, 47
Phaethon aethereus, 255
rubricauda, 6
Phalacrocorax auritus, 23, 38, 256
brasilianus, 7
penicillatus, 180
Phalaenoptilus nuttallii, 38, 48
Phalarope, Red, 75, 78, 140, 162, 170, 228–229, 234
Red-necked, 73, 75, 77, 78, 137, 140, 141, 144, 145, 149, 157–172, 222, 223, 226, 227, 228–229, 231, 232, 235
Wilson's, 73, 78, 137, 140, 141, 144, 145, 149, 150, 157–172, 222, 223, 225, 226, 227, 228–229, 231, 232, 235
Phalaropus fulicarius, 75, 78, 140, 162, 170, 228–229, 234
lobatus, 73, 75, 77, 78, 137, 140, 141, 144, 145, 149, 157–172, 222, 223, 226, 227, 228–229, 231, 232, 235
tricolor, 73, 78, 137, 140, 141, 144, 145, 149, 150, 157–172, 222, 223, 225, 226, 227, 228–229, 231, 232, 235
Phasianus colchicus, 21, 38
Pheasant, Ring-necked, 21, 38
Pheucticus melanocephalus, 40, 43, 48
Philomachus pugnax, 75, 78, 140, 157, 170
Phoebastria albatrus, 5, 176, 178, 180
Phoebe, Black, 39, 42
Phoeniconaias minor, 23
Phoenicopterus chilensis, 23
Pica nuttalli, 39
pica, 127
Picoides nuttallii, 38, 42
pubescens, 38, 42
tridactylus, 1, 2, 26
Pigeon, Feral, 21
Pipilo crissalis, 40, 43
maculatus, 40, 43
Pipit, American, 39
Sprague's, 27, 185
Piranga ludoviciana, 39, 43
olivacea, 3, 18–19, 27, 186, 191
rubra, 27
Pitelka, Frank A., see Quakenbush, L. T.
Plectrophenax hyperboreus, 27
nivalis, 16, 19, 27, 186
Plegadis chihi, 61, 181
falcinellus, 2, 175, 181
Plover, American Golden, 78
Black-bellied, 75, 76, 78, 79, 80, 82, 86, 90, 91, 93, 140, 141, 143, 144, 145, 147, 156–172, 228–229, 268–270

Greater Sand, 2, 24, 175
Mongolian, 24
Mountain, 228–229, 234
Pacific Golden, 78
Semipalmated, 75, 76, 79, 80, 82, 86, 89, 92, 140, 141, 144, 145, 147, 151, 156–172, 222, 227, 228–229, 230, 232, 234
Snowy, 75, 76, 79, 80, 82, 89, 91, 140, 141, 144, 147, 149, 151, 156–172, 215, 222, 223, 225, 226, 227, 228–229, 230, 231, 232, 235, 236
Wilson's, 176, 182
Pluvialis dominica, 78
fulva, 78
squatarola, 75, 76, 78, 79, 80, 82, 86, 90, 91, 93, 140, 141, 143, 144, 145, 147, 156–172, 228–229, 268–270
Podiceps nigricollis, 223
Podilymbus podiceps, 38
Poecile rufescens, 127
Polioptila caerulea, 39, 42
californica, 123
melanura, 123
Polysticta stelleri, 99–120
Poor-will, Common, 38, 48
Porzana carolina, 38
Progne subis, 245
Psaltriparus minimus, 39, 41, 42
Ptarmigan, White-tailed, 21
Pterodroma macroptera, 2, 5, 10
phaeopygia, 176, 179–180
sandwichensis, 176, 179
solandri, 5
ultima, 5
Ptilogonys cinereus, 2, 28–29
Puebla-Olivares, Fernando, Octavio R. Rojas-Soto, and Adolfo G. Navarro-S., First Records of Leach's Storm-Petrel in the Gulf of California, Mexico, 264
Puffinus gravis, 121–122
griseus, 121
opisthomelas, 6
pacificus, 2, 5–6
puffinus, 1, 2, 6, 22, 178–179
tenuirostris, 121
Pyle, Peter, see Howell, S. N. G.
Pyrrhuloxia, 19

Quail, California, 38, 123
Gambel's, 123
Quakenbush, Lori T., Robert H. Day, Betty A. Anderson, Frank A. Pitelka, Brian J. McCaffery, Historical and Present Breeding-Season Distribution of Steller's Eiders in Alaska, 99–120
Quiscalus mexicanus, 28
quiscula, 20, 28, 186, 191–192

Rail, Yellow, 8
Raven, Common, 114, 202–217, 258–261
Recurvirostra americana, 75, 76, 78, 79, 80, 82, 86, 88, 91, 134, 139, 140, 141, 143, 144, 145, 147, 149, 150, 151, 156–172, 222, 225, 227, 228–229, 230, 231, 232, 234, 235, 251
Redpoll, Common, 28
Redshank, Spotted, 24–25
Regulus calendula, 37, 39, 42, 44, 45
satrapa, 39, 42
Ribic, Christine A., see Strauss, E. A.
Robin, American, 39, 42
Rufous-backed, 17
Rogers, Michael M., and Alvaro Jaramillo, Report of the California Bird Records Committee: 1999 Records, 1–33
Rojas-Soto, Octavio R., see Puebla-Olivares, F.
Rosy-Finch, Black, 20
Roth, Jennifer E., see Kelly, J. P.
Ruff, 75, 78, 140, 157, 170
Ruiz-Campos, Gorgonio, see Carmona, R.
Rynchops niger, 251

Sanderling, 25, 75, 77, 79, 80, 82, 86, 92, 140, 141, 143, 144, 145, 147, 149, 156–172, 228–229, 234
Sandpiper, Baird's, 75, 78, 140, 141, 143, 144, 145, 146, 156–169, 172, 228–229
Buff-breasted, 75, 78
Curlew, 10, 25, 140, 170, 182
Least, 25, 73, 75, 77, 78, 80, 82, 85, 134, 137, 140, 141, 143, 144, 145, 147, 149, 150, 156–172, 222, 225, 226, 227, 228–229, 230, 233, 234, 235
Pectoral, 75, 78, 140, 141, 144, 146, 156–167, 172, 228–229, 234

Semipalmated, 75, 78, 140, 141, 143, 144, 146, 156–164, 228–229, 234
Solitary, 75, 78, 140, 141, 143, 144, 146, 156–172, 228–229
Spotted, 75, 76, 78, 79, 80, 82, 140, 141, 143, 144, 145, 146, 149, 151, 156–172, 222, 225, 226, 227, 228–229, 230, 233, 234
Stilt, 25, 75, 78, 140, 141, 143, 144, 145, 157–165, 170
Upland, 9–10, 188
Western, 70, 73, 74, 75, 77, 78, 80, 82, 85, 134, 137, 139, 140, 141, 143, 144, 145, 147, 149, 150, 156–172, 222, 226, 227, 228–229, 230, 231, 232, 233, 234, 235
White-rumped, 25, 182, 183, 188–189
Wood, 2, 175, 188
Sandplover, Greater, 2, 24, 175
Sapsucker, Red-breasted, 38, 128–130
Red-naped, 128–130
Yellow-bellied, 128
Sayornis nigricans, 39, 42
Scrub-Jay, Florida, 262
Western, 39, 42, 262–263
Seedeater, White-collared, 29
Seiurus motacilla, 18, 176, 186, 191
Selasphorus rufus, 38
Shearwater, Black-vented, 6
Greater, 121–122
Manx, 1, 2, 6, 22, 178–179
Short-tailed, 121
Sooty, 121
Wedge-tailed, 2, 5–6
Shrike, Loggerhead, 39, 42
Shuford, W. David, Gary W. Page, and Lynne E. Stenzel, Patterns of Distribution and Abundance of Migratory Shorebirds in the Intermountain West of the United States, 134–174; see Strauss, E. A.
Sialia currucoides, 27
mexicana, 27, 39, 42
sialis, 2, 27
Silky-flycatcher, Gray, 2, 28–29
Siskin, Pine, 40
Sitta canadensis, 39
carolinensis, 39, 42
Skimmer, Black, 251
Smew, 176, 181–182
Snipe, Common/Wilson's, 38, 75, 78, 140, 141, 143, 144, 145, 147, 149, 151, 157–172, 225, 226, 228–229, 235, 236
Somateria spectabilis, 181
Sora, 38
Sparrow, Baird's, 191
Brewer's, 40, 43, 48
Cassin's, 186
Chipping, 40, 43, 48
Field, 176, 186
Fox, 40, 41, 43, 44, 46, 47
Golden-crowned, 40, 41, 43, 44, 46, 47
House, 21, 40
Lark, 40, 43, 48
LeConte's, 19
Lincoln's, 40, 41, 43, 44, 46, 47
Nelson's Sharp-tailed, 19
Rufous-crowned, 40
Savannah, 40, 43, 48, 191
Song, 40, 43, 47
White-crowned, 40, 41, 43, 44, 46
Sphyrapicus nuchalis, 128–130
ruber, 38, 128–130
varius, 128
Spizella breweri, 40, 43, 48
passerina, 40, 43, 48
pusilla, 176, 186
Spoonbill, Roseate, 23
Sporophila torqueola, 29
Starling, European, 21, 39, 48, 262
Stenzel, Lynne E., Catherine M. Hickey, Janet E. Kjelmyr, Gary W. Page, Abundance and Distribution of Shorebirds in the San Francisco Bay Area, 69–98; see Shuford, W. D.
Stercorarius pomarinus, 115
Sterna anaethetus, 2, 190
antillarum, 215
caspia, 251, 252
elegans, 189
fuscata, 14
lunata, 190
maxima, 251
nilotica, 251
sandvicensis, 189
Stilt, Black-necked, 75, 76, 79, 80, 82, 91, 134, 139, 140, 141, 142, 143, 144, 145, 146, 149, 150, 156–172, 225, 228–229
Stint, Long-toed, 25
Red-necked, 25, 188

Stork, Wood, 251–252
Storm-Petrel, Black, 187, 256
Fork-tailed, 121
Leach's, 264
Markham's, 2, 175, 187
Tristram's, 187
Wedge-rumped, 22–23, 24
Wilson's, 22, 23
Strauss, Emilie A., Christine A. Ribic, and W. David Shuford, Abundance and Distribution of Migratory Shorebirds at Mono Lake, California, 222–240
Streptopelia chinensis, 21
decaocto, 2, 176
Sturnella neglecta, 40, 188
Sturnus vulgaris, 21, 39, 48, 262
Sula dactylatra, 3, 6–7, 176, 180, 187
granti, 2, 3, 7, 175–176, 180, 187
leucogaster, 2, 7, 180, 187, 255
nebouxii, 256
sula, 181
Surfbird, 73, 75, 78, 140, 170
Swallow, Barn, 27, 39
Cave, 27
Cliff, 27, 39, 65–66
Tree, 39
Violet-green, 39
Swan, Trumpeter, 8, 23–24
Tundra, 23–24
Whooper, 8
Swift, Vaux's, 38
Synthliboramphus craveri, 256

Tachycineta bicolor, 39
thalassina, 39
Tanager, Scarlet, 3, 18–19, 27, 186, 191
Summer, 27
Western, 39, 43
Tattler, Wandering, 73, 75, 78
Tern, Bridled, 2, 190
Caspian, 251, 252
Elegant, 189
Gray-backed, 190
Gull-billed, 251
Least, 215
Royal, 251
Sandwich, 189
Sooty, 14
White-winged, 2, 11, 14
Thalassarche cauta, 1, 4–5, 9, 176, 178, 179
Thrasher, California, 39, 43
Thrush, Eyebrowed, 2, 175
Gray-cheeked, 12, 17
Hermit, 39, 41, 42, 45, 47
Swainson's, 39, 42
Varied, 39
Wood, 17
Thryomanes bewickii, 39, 42
Tinnin, David S., A Western Scrub-Jay Preying on Deer Mice, 262–263
Titmouse, Oak, 39, 42
Towhee, California, 40, 43
Spotted, 40, 43
Toxostoma redivivum, 39, 43
Tringa erythropus, 25
flavipes, 73, 75, 76, 79, 80, 82, 89, 137, 140, 141, 143, 144, 145, 146, 151, 156–172, 188, 226, 228–229
glareola, 2, 175, 188
melanoleuca, 38, 73, 75, 76, 78, 80, 82, 89, 137, 140, 141, 143, 144, 145, 146, 151, 156–172, 226, 228–229
nebularia, 2, 175
solitaria, 75, 78, 140, 141, 143, 144, 146, 156–172, 228–229
Troglodytes aedon, 39, 42
troglodytes, 39, 42, 48
Tropicbird, Red-billed, 255
Red-tailed, 6
Tryngites subruficollis, 75, 78
Turdus migratorius, 39, 42
obscurus, 2, 175
rufopalliatus, 17
Turkey, Wild, 21, 38
Turnstone, Black, 73, 75, 77, 79, 140, 162, 170
Ruddy, 73, 75, 77, 79, 140, 141, 143, 144, 145, 147, 156–170, 228–229, 234
Tyrannus crassirostris, 15–16, 185
forficatus, 16
verticalis, 39
Tyto alba, 38

Uria aalge, 215
lomvia, 14

Veery, 126, 127
Vermivora celata, 39, 41, 43, 44, 45, 47
chrysoptera, 185
pinus, 17, 191
ruficapilla, 39, 43, 44, 48

Vireo, Blue-headed, 17, 26–27, 176, 185, 191
Cassin's, 17, 27, 39, 42
Hutton's, 39, 42, 48, 127
Warbling, 39, 42, 48
White-eyed, 16, 185
Yellow-green, 17, 27, 185
Yellow-throated, 2, 16–17, 191
Vireo cassinii, 17, 27, 39, 42
flavifrons, 2, 16–17, 191
flavoviridis, 17, 27, 185
gilvus, 39, 42, 48
griseus, 16, 185
huttoni, 39, 42, 48, 127
solitarius, 17, 26–27, 176, 185, 191
Vulture, Turkey, 38, 241, 243, 244

Wagtail, Black-backed, 176, 185, 194
White, 176
Warbler, Audubon's, 39, 41, 43, 47
Bay-breasted, 3
Black-and-white, 62
Black-throated Gray, 39, 43
Blue-winged, 17, 191
Cape May, 3
Connecticut, 13, 18, 186, 191
Golden-winged, 185
Grace's, 191
MacGillivray's, 39, 43, 44, 48
Mourning, 3, 18, 27, 191
Myrtle, 39, 41, 43, 47, 48
Nashville, 39, 43, 44, 48
Orange-crowned, 39, 41, 43, 44, 45, 47
Pine, 18, 185, 191
Red-faced, 18
Wilson's, 39, 43, 46, 47
Worm-eating, 18, 27, 186, 191
Yellow, 37, 39, 41, 43, 45, 47
Yellow-rumped, 39, 41, 43, 47, 48
Yellow-throated, 17–18
Waterthrush, Louisiana, 18, 176, 186, 191
Waxwing, Cedar, 39
Webb, William C., and Norman C. Ellstrand, First Record of Double Brooding by the Common Raven, 258–261
Whimbrel, 75, 76, 78, 79, 80, 82, 89, 140, 141, 143, 144, 145, 146, 147, 148, 150, 156–170, 228–229
Whistling-Duck, Black-bellied, 7–8, 181
Willet, 70, 75, 76, 78, 79, 80, 82, 86, 88, 91, 140, 141, 143, 144, 145, 147, 149, 150, 151, 152, 156–172, 228–229
Wilsonia pusilla, 39, 43, 46, 47
Woodpecker, Acorn, 38
Downy, 38, 42
Nuttall's, 38, 42
Red-headed, 2, 15
Three-toed, 1, 2, 26
Wood-Pewee, Eastern, 26
Western, 26, 38, 42, 47
Wren, Bewick's, 39, 42
House, 39, 42
Marsh, 39, 42
Sedge, 176, 185
Winter, 39, 42, 48
Wrentit, 39, 42

Xanthocephalus xanthocephalus, 40

Yellowlegs, Greater, 38, 73, 75, 76, 78, 80, 82, 89, 137, 140, 141, 143, 144, 145, 146, 151, 156–172, 226, 228–229
Lesser, 73, 75, 76, 79, 80, 82, 89, 137, 140, 141, 143, 144, 145, 146, 151, 156–172, 188, 226, 228–229
Yellowthroat, Common, 39, 41, 43

Zenaida macroura, 38
Zonotrichia atricapilla, 40, 41, 43, 44, 46, 47
leucophrys, 40, 41, 43, 44, 46

Western Field Ornithologists and New Mexico Ornithological Society Joint Meeting

July 24–27, 2003

Western New Mexico University
Silver City, New Mexico

CONFERENCE INFORMATION

The 28th annual meeting of the Western Field Ornithologists and the 41st annual meeting of the New Mexico Ornithological Society will be held jointly at the campus of Western New Mexico University in Silver City, New Mexico, July 24–27, 2003. The theme of the meeting will be the birds of the Mexican Borderlands, and it will promote exchange of biological information with professional and amateur ornithologists from both sides of the international border. Situated in the Madrean oak woodland habitats of the Southwestern Borderland region, Silver City, New Mexico, affords unique birding and orthithological research opportunities for the casual birder as well as the professional biologist. Late July is prime time for hummingbird viewing in this region, and up to 10+ species can be found within two hours' driving distance from the site of the meetings. Furthermore, this area affords great opportunities for viewing many southwestern specialty species such as the Common Black-Hawk, Zone-tailed Hawk, Montezuma Quail, Yellow-billed Cuckoo, Flammulated and Spotted Owls, Greater Pewee, Brown-crested Flycatcher, Mexican Jay, Juniper Titmouse, Crissal Thrasher, Olive and Red-faced Warblers, Painted Redstart, and Abert's Towhee.

Activities: Several organized half-day field trips are available, including a representative sampling of birds and habitats of southwestern New Mexico and northwestern Chihuahua. Participants can explore the region's diverse habitats on their own as well, using the just published third edition of the *New Mexico Bird Finding Guide* (available for $20, postage included, from New Mexico Ornithological Society, P. O. Box 3068, Albuquerque, NM 87190-3068). A field trip to the Sierra Madre Occidental in Chihuahua, Mexico, follows the meeting. As at previous WFO meetings, afternoon professional paper sessions and identification slide panels are planned. Social activities include a welcoming reception, a Friday evening social event, and the concluding banquet and evening program on Saturday. For those diverse individuals who are slightly less interested in the birding opportunities, there are also many other cultural and historical sites to visit in the immediate vicinity, such as Gila Cliff Dwelling National Monument.

Speakers: The featured speaker after the Saturday evening banquet is Dr. Noel Snyder from Portal, Arizona. Dr. Snyder is the co-author of *The California Condor: A Saga of Natural History and Conservation* and *Birds of Prey: Natural History and Conservation of North American Raptors*. His presentation is entitled "Conservation and Reintroduction of Thick-billed Parrots: Future Prospects."

On Friday night 25 July Dr. Dale Zimmerman from Silver City, New Mexico, will be making a presentation on the birds of the borderlands region. Dr. Zimmerman is a long-time resident of Silver City and a pioneer in many ornithological investigations within this bird-rich region.

Lodging: A block of 30 rooms has been reserved at the Silver City Holiday Inn Express (505-538-2525) for this meeting. Prices are set at $60/night and are reserved under "WFO Meetings" with a confirmation number 68518772. These rooms are available on a first-come first-served basis until 15 June 2003. A wide variety of hotels, bed-and-breakfasts, and guest inns is also available in the greater Silver City area. This is a popular destination for summer visitors, so make reservations early. Please visit www.silvercity.org on the World Wide Web to view alternate accommodations, prices, and telephone numbers, as well as recreational activities for the area.

For additional information contact dave_krueper@fws.gov and watch WFO's website, www.wfo-cbrc.org, for updates.

Call for Papers and Poster Presentations

GUIDELINES: Oral and poster presentations should reflect original research, or summarize existing unpublished information, and be presented in a manner that will be of interest to serious amateur field ornithologists. Talks and posters relating to the following general themes are especially solicited for the current meeting.

Ecology, population biology, and conservation of birds in New Mexico, southern Arizona, western Texas, Sonora, and/or Chihuahua.

Systematics and biogeography of the birds of the Pacific Coast region, the North American interior (including Mexico), and the interface between the two.

New information on field identification problems relevant to the birds of western North America and the eastern Pacific Ocean.

Techniques for field study of birds, including censusing, monitoring, and other studies; results of studies resulting from the application of such techniques.

We expect to allot 20 minutes per oral presentation, which should include 5 minutes for questions and discussion; longer time slots (30 minutes) are negotiable.

Posters should fit within a width of 6 feet.

An abstract of your presentation or poster should be submitted to Ted Floyd (tedfloyd57@hotmail.com), electronically or on paper (Ted Floyd, P. O. Box 7974, Boulder, CO 80306-7974). All abstracts should be received by 1 June 2003, and should be submitted in the following format:

YOUR LAST NAME, YOUR FIRST NAME. Your affiliation (if any), complete mailing address, e-mail address (optional). Title of Your Talk. Brief (300 word maximum) summary of the goals, results, and conclusions of your study.

For more information about the meeting, contact David Krueper (U.S. Fish & Wildlife Service, P. O. Box 1306, Albuquerque NM 87103; 505-248-6877; dave_krueper@fws.gov).

We look forward to seeing you in Silver City!

WESTERN BIRDS

World Wide Web site: www.wfo-cbrc.org

Quarterly Journal of Western Field Ornithologists

President: Mike San Miguel, 2132 Highland Oaks Dr., Arcadia, CA 91006; sanmigbird@aol.com

Vice-President: Daniel D. Gibson, University of Alaska Museum, 907 Yukon Dr., Fairbanks, AK 99775-6960

Treasurer/Membership Secretary: Robbie Fischer, 1359 Solano Drive, Pacifica, CA 94044; robbie22@pacbell.net

Recording Secretary: Kei Sochi, The Nature Conservancy, Western Regional Office, 2060 Broadway, Suite 230, Boulder, CO 80302; ksochi@tnc.org

Directors: Ted Floyd, Kimball L. Garrett, Daniel D. Gibson, Bob Gill, Gjon Hazard, Dave Krueper, Mike San Miguel, Thomas Ryan, W. David Shuford, Catherine Waters, David Yee

Editor: Philip Unitt, San Diego Natural History Museum, P. O. Box 121390, San Diego, CA 92112-1390; birds@sdnhm.org

Associate Editors: Daniel D. Gibson, Robert A. Hamilton, Ronald R. LeValley, Tim Manolis, Kathy Molina, Michael A. Patten

Graphics Manager: Virginia P. Johnson, 4637 Del Mar Ave., San Diego, CA 92107

Photo Editor: Peter La Tourrette, 1019 Loma Prieta Ct., Los Altos, CA 92024

Featured Photo: Robert A. Hamiltom, 34 Rivo Alto Canal, Long Beach, CA 90803

Book Reviews: Steve N. G. Howell, Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach, CA 94970

Secretary, California Bird Records Committee: Guy McCaskie, P. O. Box 275, Imperial Beach, CA 91933-0275; guymcc@pacbell.net

Chairman, California Bird Records Committee: Richard A. Erickson, LSA Associates, 1 Park Plaza, Suite 500, Irvine, CA 92614; richard.erickson@lsa-assoc.com

Membership dues, for individuals and institutions, including subscription to Western Birds: Patron, $1000.00; Life, $400 (payable in four equal annual installments); Supporting, $60 annually; Contributing, $34 annually; Family $30; Regular U.S. $25 for one year, $46 for two years, $70 for three years. Dues and contributions are tax-deductible to the extent allowed by law.

Send membership dues, changes of address, correspondence regarding missing issues, and orders for back issues and special publications to the Treasurer. Make checks payable to Western Field Ornithologists.

Back issues of Western Birds within U.S. $28 per volume, $7.50 for single issues, plus $1 per issue for postage. Outside the U.S. $34 per volume, $9 for single issues plus $2 per issue shipping.

The California Bird Records Committee of Western Field Ornithologists revised its 10-column Field List of California Birds in February 2002. The last list covered 613 accepted species; the new list covers 619 species. Please send orders to WFO, c/o Robbie Fischer, Treasurer, 1359 Solano Drive, Pacifica, CA 94044. California addresses please add 8.25% sales tax.

Quantity: 1–9, $1.50 each, includes shipping and handling; 10–39, $1.30 each, add $2.00 for shipping and handling; 40 or more, $1.15 each, add $4.00 for shipping and handling.

Published March 31, 2003 ISSN 0045-3897

NEW 80 MM SPOTTING SCOPES

SWAROVSKI... MAKING GOOD THINGS BETTER

Making Good Things Better has been a guiding principle at Swarovski Optik for over 50 years. It's the driving force behind our four, NEW ATS & STS and ATS HD & STS HD, 80 MM Spotting Scopes This new series of scopes is lighter in weight, smaller in size, armor-covered and has a new, brighter resolution, greater than any other scope on the planet, including the "Premium Reference Standard" AT/ST 80 Scopes they succeed.

The NEW 80's represent the ultimate design effort from the Optical Engineers at Swarovski Optik, and set a new "Optical Reference Standard" for performance in any premium spotting scope. The new scopes are entirely made at the Swarovski Optik factory in Austria. This ensures that full quality control is exercised throughout every step of manufacturing, delivering the finest optical performance backed by our legendary Limited Lifetime Warranty.*

All of the new 20-60X and fixed power eyepieces, camera adapters and accessories are fully interchangeable, producing the same premium resolution and magnification when attached to any of the new family of 65 and 80 MM models.

Call: 800-426-3089, e-mail: info@swarovskioptik.com or visit: www.swarovskioptik.com for your nearest dealer and more information.

SWAROVSKI
OPTIK
WITH THE EYES OF A HAWK

Swarovski Optik North America, Ltd., 2 Slater Road, Cranston, RI 02920

*Original USA warranty card must be postmarked within 30 days of purchase from an authorized Swarovski dealer in good standing.
The registered warranty holder must return entire product with warranty claim.
Note: The "Limited Lifetime USA Warranty" is only available with genuine Swarovski Optik products purchased from an authorized Dealer in good standing.

SWAROVSKI
OPTIK
A Proud Sponsor of Western Field Ornithologists